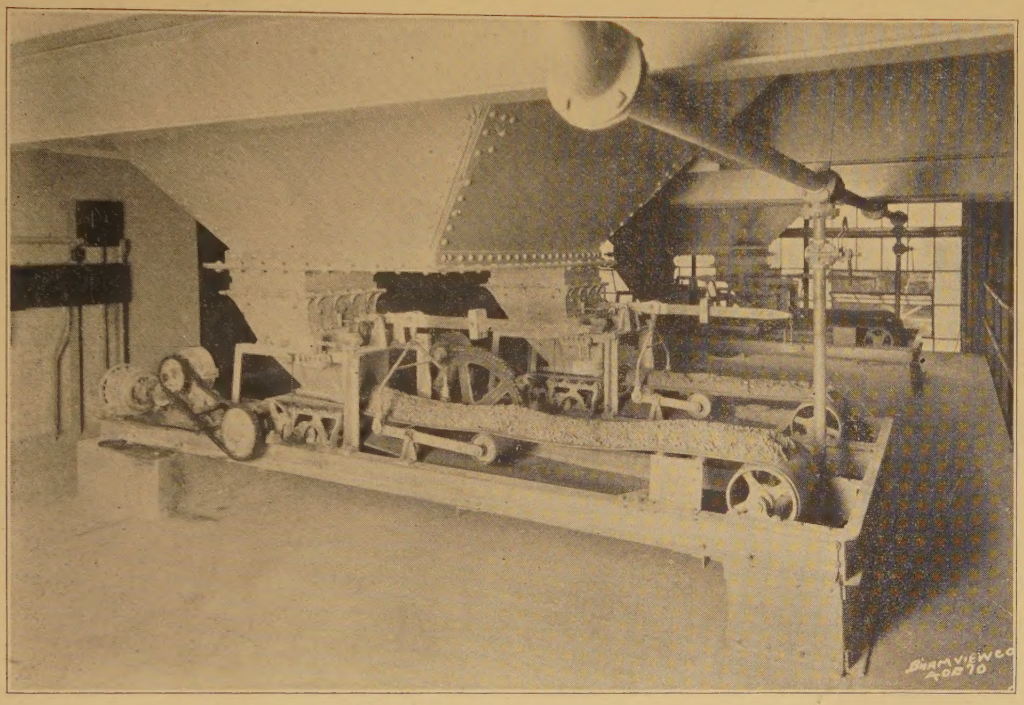
MILL SECTION of

Concrete

Schaffer Poidometer



Photograph showing four Poidometer proportioning stone and clay at the new plant of Phoenix Portland Cement Corporation at Birmingham, Alabama.

The Automatic Feeder—Weigher—Conveyor

Poidometers are being used by many of the leading cement companies for proportioning stone and shale, also clinker and gypsum.

They are accurate: in fact we guarantee them in most cases to be 99% accurate, and will deliver bulk materials in quantities to suit your requirements. They protect the quality of your product and prevent waste as well as errors.

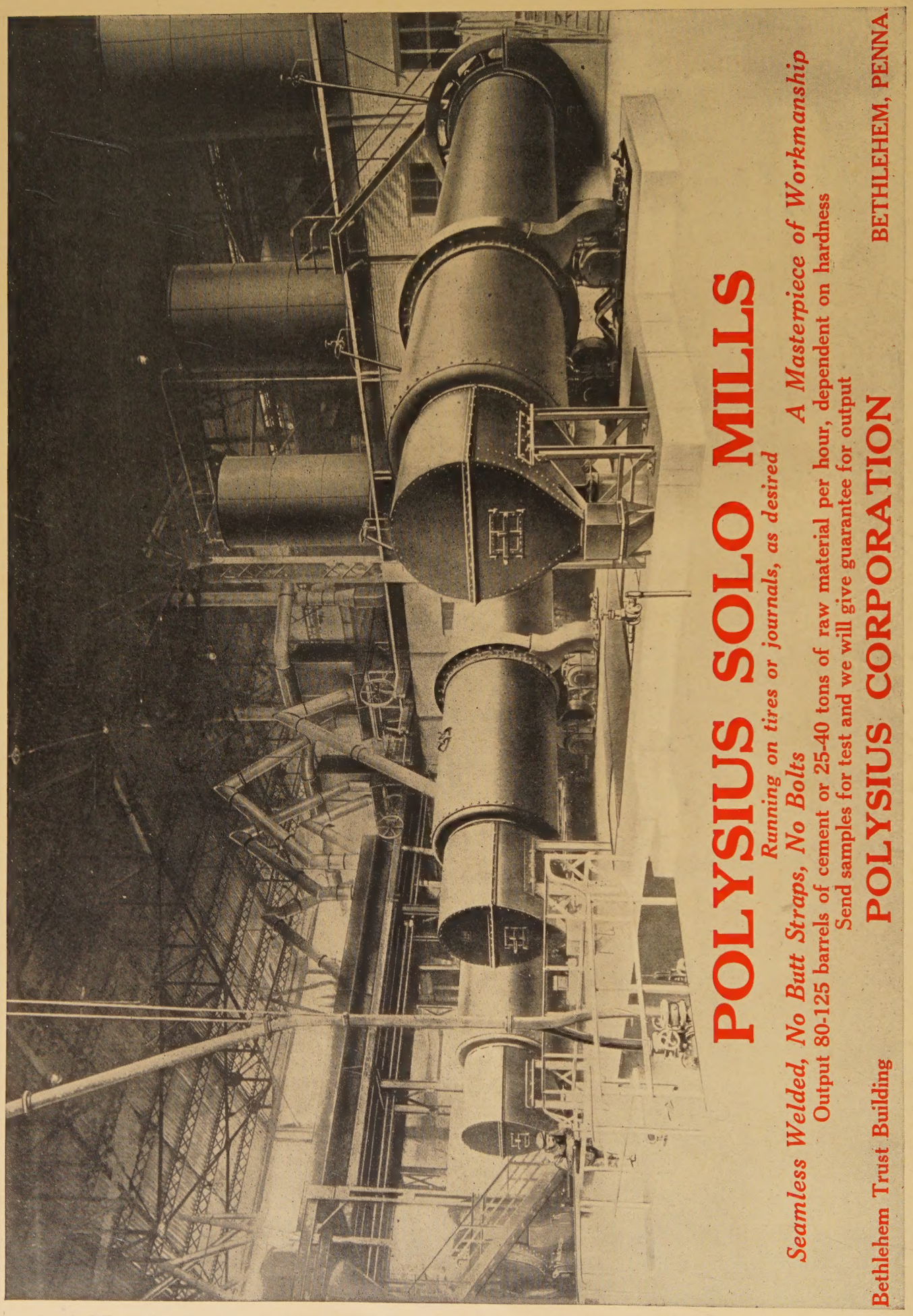
Poidometers are also being used for weighing, feeding, and recording the amount of coal delivered to the boilers, as well as feeding materials to the compeb mills.

LET US BUILD PROFIT FOR YOU
Engineering Advice and Catalog on Request

SCHAFFER POIDOMETER COMPANY

2828 Smallman Street Pittsburgh, Pennsylvania

Index to Advertisers on Page 91 of This Section


POLYSIUS SOLO MILLS
Running on tires or journals, as desired
A Masterpiece of Workmanship
Seamless Welded, No Butt Straps, No Bolts
Output 80-125 barrels of cement or 25-40 tons of raw material per hour, dependent on hardness
Send samples for test and we will give guarantee for output
POLYSIUS CORPORATION
Bethlehem Trust Building
BETHLEHEM, PENNA.

Index to Advertisers on Page 91 of This Section

MILL SECTION of

Concrete

The Mill Edition of CONCRETE is edited for the manufacturers of portland cement, lime and similar products. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition.

The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

Volume 31 August, 1927 Number 2

CONTENTS

Phoenix Portland Cement Corporation Plant Built to Approach Ideal—*(Illus.)* 93

A description of the new Birmingham plant showing how the design features met the four requirements set by the builders.

Interpreting Cement Analyses—*(Illus.)* 103

A mathematical method for rapidly calculating the potential constitution of cements.

Nomenclature and Descriptions of the Special Cements 105

Edwin C. Eckel classifies cements into eight varieties to simplify possible future discussions.

Editorials 107

Classification of Cements
Behavior of Cement
Cloth or Paper?

Men and Mills—*(Illus.)* 108

Cement Statistics for June—*(Illus.)* 111

Lime Association Makes Plans for Future Activities 112

Home Demand Causes Slump in Japanese Exports 112

Japanese Establish Two New Cement Firms 112

Motion Picture Tells Story of Electric Detonator 112

Mill Equipment—*(Illus.)* 113

Cost of Electric Motor Burn-outs 114

Bureau Determines New Lime Soundness Test 114

REGULAR SECTION

Relation Between the Characteristics of Portland Cement and Deterioration of Concrete—*(Illus.)* 23

A. S. T. M. Discusses Cement, Aggregate and Concrete Quality 35

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INDEX TO ADVERTISEMENTS

Allis-Chalmers Mfg. Co. 130
American Oil Corp. 133
Babcock & Wilcox Co. 125
Baker & Spencer, Inc. 134
Bates Valve Bag Co. 118
Bradley Pulverizer Co. 135
Burrell Engineering & Const. Co. 137
Caldwell, H. W., & Son 120
Coates Steel Products Co. 92
Edge Moor Iron Co. 126
Engineering & Designing 134
Fuller Co., The 115
Green Fire Brick Co., A. P. 129
Heine Boiler Co. 122
Hercules Powder Co. 116-117
Hunt, Robert W., Co. 86
James Mfg. Co., D. O. 128
Jones Foundry & Machine Co., W. A. 124
Jeffrey Mfg. Co., The 121
Keystone Driller Co. 135
Kritzer Co., The 134
Latimer, Robert, & Co. 114
Link-Belt Co. 131
Manitowoc Engineering Works 133
Meade, Richard K., & Co. 134
Pennsylvania Crusher Co. 136
Polysius Corp. 90
Quigley Furnace Spec. Co., Inc. 132
Riehle Bros. Testing Machine Co. 136
Sargent, E. H., & Co. 134
Schaffer Poidometer Co. 89
Smidth, F. L., Co. 138
Sonntag, C. H. 134
Standard Oil Co. 127
Super Cement Co., The 88
Timken Roller Bearing Co., The 12
Traylor Engineering & Mfg. Co. 119
Webster Mfg. Co. 123
Wood's, T. B., Sons Co. 137

COATES GRINDING MEDIA

"TUNGSCO" STEEL NUGGETS

We recommend these grinding bodies without qualification for use in all types of compartment and tube mills. We make them from high quality rolled steel by a special process which renders them durable, tough and free from checking or breakage in any form.

In order to meet all conditions of service, we make these nuggets in two grades:

"TUNGSCO" Chromium
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Forged under controlled conditions from high chromium and carbon steel. A hard and long wearing grinding body of moderate price and very satisfactory performance. A favorite in many mills.

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Write Us for Prices

Coates Steel Products Company

GREENVILLE, ILLINOIS

Largest Exclusive Manufacturers of Grinding Media

Index to Advertisers on Page 91 of This Section

MILL SECTION of

Concrete

Vol. 31 Chicago, August, 1927 No. 2

Phoenix Portland Cement Corporation Plant Built to Approach An Ideal

New Mill Illustrates Evolution of Cement Plant Design —Has Unusually Large Equipment Units—All American Equipment, Much of Which Is of Special Design—High Quality Product—Exceptionally Low Labor and Equipment Maintenance Costs—Plant Is Definite Step Forward in Cement Manufacturing

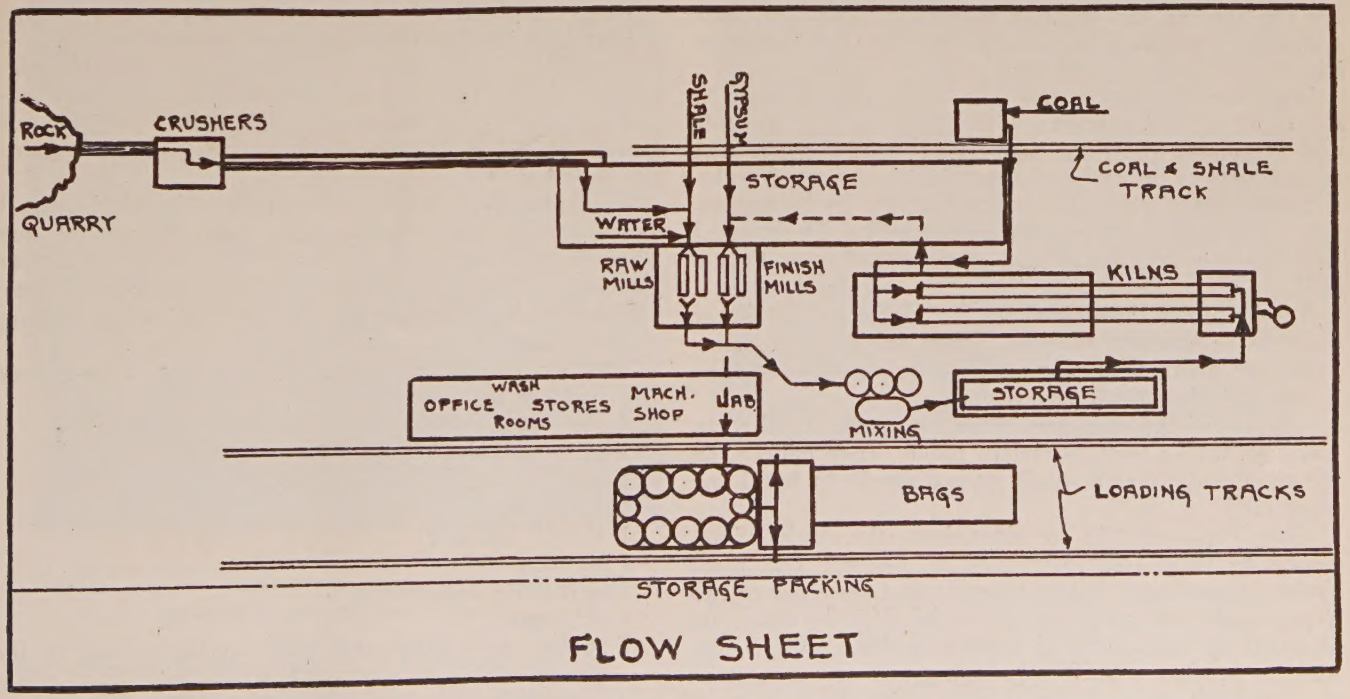
"WE visited all the important cement plants in the United States and Europe, and then tried to make this plant the best of them all."

That was the spirit behind the building of the new plant of the Phoenix Portland Cement Corporation at Birmingham. The completed plant is as nearly the realization of an ideal as it is possible for buildings and machinery to express in concrete form the hopes and aspirations of the builders.

It is not merely another cement plant. It was designed to make better cement at a lower cost. In every step of its design and construction certain definite requirements were rigidly kept in mind. Every detail had to meet these objectives:

First. Quality of Cement. This, in the last analysis, was the primary object to which all others were secondary.

Second. Efficient Grouping of Equipment. A glance at the accompanying flow sheet will illustrate the compactness of the layout. This was considered one of the most important items in reducing labor costs. Equipment is so arranged that a minimum of labor is required to operate the plant. Operation of the plant proper (i. e., the grinding, slurry, burning, coal preparation and storage



FLOW SHEET

departments) requires only twelve men per shift, a record in plant operation.

The location of the laboratory provides one illustration of the compactness of the design and its effect on quality and operation costs. All the principal points at which the quality of the cement is controlled—the grinding, mixing, burning, and shipping departments—are not more than 100 feet away from the laboratory.

Third. Low Maintenance. This requirement meant, first of all, large units of equipment. It is this feature that cuts down equipment maintenance costs and helps to reduce labor costs.

It is this feature, too, that is one of the most dramatic in the plant. To describe it is to deal in superlatives. Here are the longest kilns in the world, the largest grinding units ever installed in any cement plant, the first double tube coolers ever installed, etc., etc.

All the equipment is American made. Much of it is new and especially designed for this plant. It was not a desire to be sensational that resulted in the selection and use of big, oversize units. The only object was to make a better cement at a lower cost. The results, both in operation costs and in quality of cement, have justified the decision. The long kilns, for instance, require less coal per barrel with the wet process than even good fuel records show with the dry process. And the first cost of the installation was not greater than the cost of other good plants.

Fourth. Appearance. Somebody jokingly remarked that before you go through the plant, get a shoe shine. Then, if you have a speck of dust on your shoes after you have visited every department of the plant, the company will pay your transportation back home. That, of course, is a pleasantry, but it does not exaggerate the cleanliness of the entire plant.

Approximately $100,000 was expended in dust collecting apparatus and the result is a mill absolutely free from dust. The air in the grinding department is so clean that it was practical to install the driving motors and the main plant switchboard in the same room as the grinding mills themselves.

All equipment is attractively painted and the floor in the motor section of the mill room is covered with a rubber tile flooring that remains absolutely clean. All dust collecting equipment was furnished by the Northern Blower Company of Cleveland.

Dust elimination was only one of the efforts made to secure an attractive plant. After the design of the mill was completed from an engineering standpoint, it was turned over to an architect for criticism from an architectural point of view. There is a difference in the appearance of the plant from other cement mills. The general impression is that the plant is more of a factory than a mill.

The buildings themselves are for the most part either concrete or concrete encased. There are concrete driveways with ornamental concrete lighting standards and the grounds are beautifully landscaped.

Officials of the company claim no credit for this attempt to have a neat, attractive plant. They believe, on the other hand, that it would be a discredit to build any other kind.

Every department in the plant shows the results of adhering to these four principles of design. The plant design is *consistent*. It is not merely that some one or two departments were particularly favored. It it the same care in planning *every* item of equipment that makes it possible to produce a uniformly high grade of cement with a remarkably small force of men, using large units of equipment that require a minimum of upkeep in a plant that everywhere is clean and efficient.

Location

The plant is located in the heart of the rapidly developing Birmingham District. Specifically, it is about half way between Birmingham and Bessemer. This puts these two active industrial cities within approximately seven miles of the plant.

Railroads serving the plant are the Atlanta, Birmingham and Coast Railway, and the Alabama Great Southern Railway, a part of the Southern system. The mill is located within the Birmingham switching area.

As it now stands, the plant will produce 4,000 barrels of cement daily. Provisions were made in the design to add another kiln and its corresponding equipment to the present two kiln units and thus increase the capacity 50 per cent.

Power for operating the mill is purchased from the Alabama Power Company, of Birmingham.

Raw Materials

The raw materials used are limestone taken from the quarry adjacent to the plant, sandstone and shale. The latter two materials are both taken from another quarry at Lewisburg, Alabama, located about 14 miles from the plant. They are delivered by rail on a switching charge per car. The material from the limestone quarry at the plant constitutes about 90 per cent of the raw material used. Only about 10 per cent of the other materials are needed to secure the proper blending of the raw materials.

The plant quarry offers the first opportunity to see the application of the principles that characterize the design of the entire plant. Here from 1500 to 1800 tons of rock are quarried daily with a force of only 14 men.

The principle of using large units of equipment so as to reduce maintenance costs is illustrated in the use of a Type 100-B Bucyrus full revolving, caterpillar electric shovel. Ordinarily this shovel is equipped with a 4-yard dipper, but in order to reduce repair costs and to allow a margin of reserve strength, a 2½-yard dipper is used. This shovel is operated by one man and can travel the length of the quarry (about 400 feet) in ten minutes.

There are about 140 acres of limestone, enough to supply this material for 100 years at the present rate of production. Drilling is done by means of a 6-inch Loomis-Clipper drill. The rock is shot so that very little secondary shooting is necessary. One man, operating an Ingersoll-Rand jackhammer, can accomplish the secondary shooting.

The rock is loaded by the Bucyrus shovel described above into 6-cubic-yard capacity quarry cars of the Phoenix type, made by the Easton Car and Construction Company. Two 12-ton General Electric storage battery locomotives haul the cars to the foot of an incline leading to the crusher house.

The labor of the 14 men operating the limestone quarry is divided as follows.

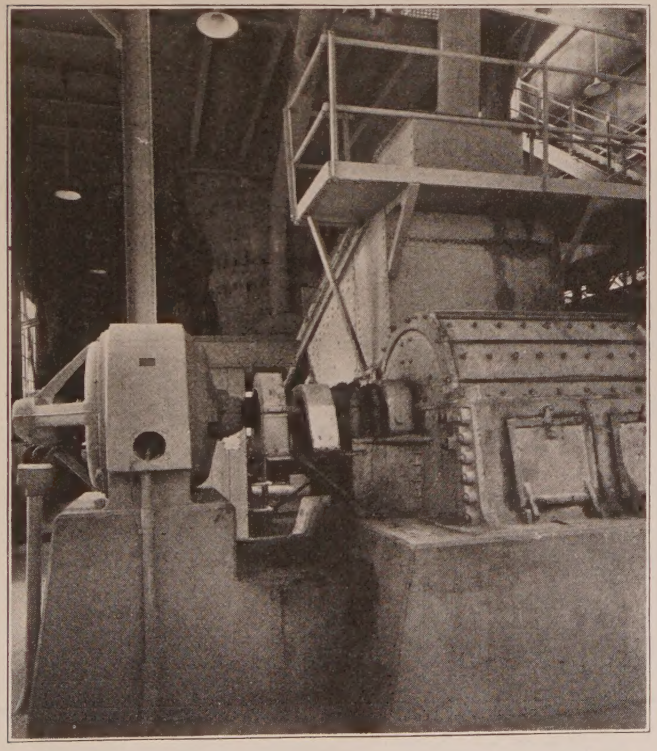
2 men—well drillers
2 men—well drill helpers
1 man—operating jackhammer
1 powder man
1 shovel operator
1 pit man
1 locomotive operator
1 switchman
1 hooker, who hooks the cable on the incline to the quarry cars
1 pump man

2 laborers who keep up track and help where necessary. 14 men, total.

The shale at the Lewisburg quarry is drilled and shot in a similar manner. It is then loaded by a 20-B Bucyrus electric caterpillar shovel.

Only 14 men are needed to operate the quarry which produces from 1500 to 1800 tons of rock daily

This material is reduced to ½-inch size at the quarry by means of a No. 20 Allis-Chalmers crusher and a No. 5 Williams hammer mill. It is then loaded into gondolas and shipped to the plant at a switching rate per car. Three men quarry, crush and load from 150 to 200 tons of this material each day.

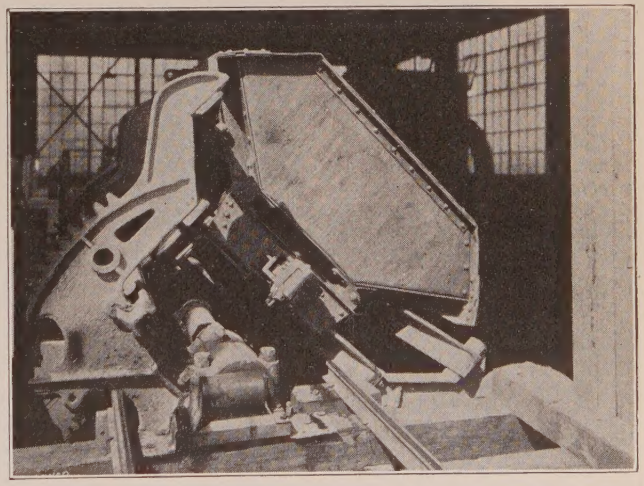


The crusher house equipment. In the background is the 42-inch primary crusher. In the foreground is the hammer mill where the rock is reduced to tube mill size

Crusher Plant

The crushing plant serving the limestone quarry is in a reinforced concrete building located at the edge of the quarry and about 300 feet from the raw materials storage. An inclined track leads from the top of the crusher building to the floor of the quarry. The loaded quarry cars are pulled to the bottom of the incline as previously described. Here a cable is fastened to the cars and a mine hoist, manufactured by the Stewart Manufacturing Company, pulls the cars to the top of the incline.

Here, also, the builders made use of a piece of equipment that is commonly used in the mines in the Birmingham district. A rotary car dumper, also made by the Stewart Manufacturing Company, takes the cars and dumps the rock into the crusher. This is operated by a single control lever which releases the brake and at the same time throws the switch. Power for operating the car dumper is supplied by a 10 hp. motor operating through a Falk speed reducer. The same operator who operates the hoist also dumps the rock.



A rotary car dumper, such as is used at the mines in the Birmingham district was installed in the crusher building. It lifts the car bodily, dumping the rock into the primary crusher

The rock is dumped directly from the cars into a 42-

inch Allis-Chalmers gyratory crusher which reduces the material to 6-inch size. The crusher discharges onto a Link-Belt pan conveyor which feeds a No. 9 Jumbo Williams hammer mill. Here the rock is reduced to tube mill size.

The combined materials storage. The building at the right houses the coal department.

Like all other departments in the plant, the crusher building is entirely free from dust. All dust is collected by an arrester type installation furnished by the Northern Blower Company, and is returned to the belt.

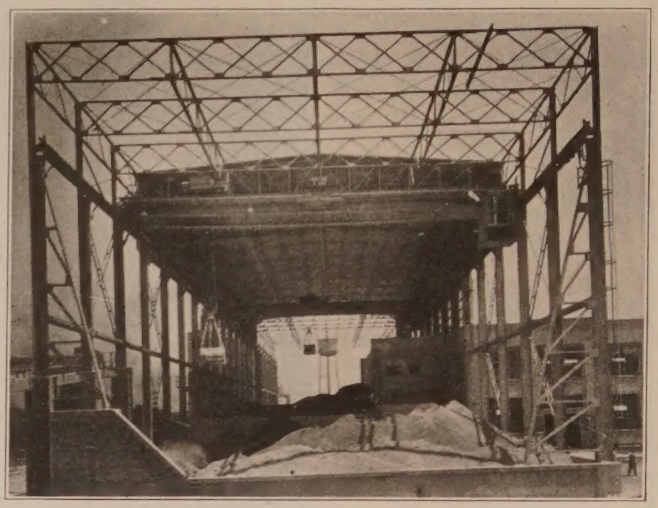
Only two men are needed to operate the crusher department. One man operates the hoist and the car dumper. The other does the other odd jobs that require attention.

A 30-inch belt, supported on a concrete trestle, carries the ½-inch rock up an incline to storage. This belt is 350 feet between pulley centers and is driven by a 30 hp. motor through a Falk speed reducer.

Materials Storage

The storage building, paralleling the kilns, is 468 feet long and 80 feet wide. The compartments for the various materials are separated by concrete partitions. The first section, nearest the crusher building, provides space for 10,000 tons of limestone. Next comes a compartment providing for the storage of 4,000 tons of shale. Following this is space for 500 tons of gypsum, 60,000 barrels of clinker and 8,000 tons of coal.

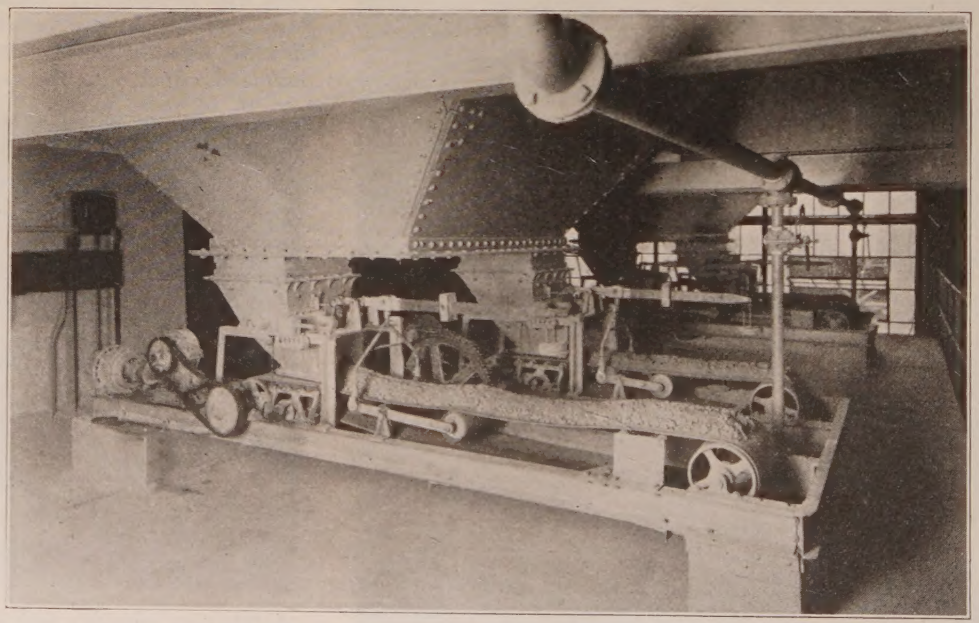
All these materials are served by two Whiting cranes equipped with 2½-yard Blaw-Knox buckets. The cranes span the width of the storage building and can handle any of the materials stored. They are of a larger size and powered by larger motors than needed, conforming to the principle which dictates low upkeep costs.



Two Whiting cranes with 2½ yard buckets handle the materials in storage

Shale and gypsum are delivered in bottom dump cars on a sidetrack paralleling the storage building. They are dumped into track hoppers from which they are taken by Link-Belt elevators and discharged into storage.

Each of the four grinding mills is fed by two Schaffer poidometers. In the raw end they proportion the limestone and shale, in the finish end the clinker and gypsum

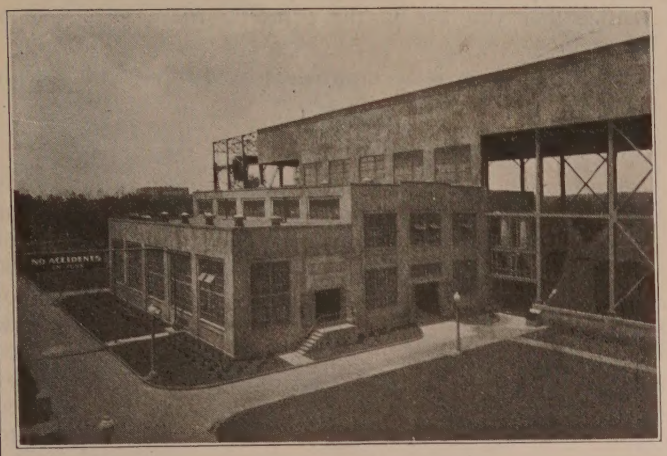


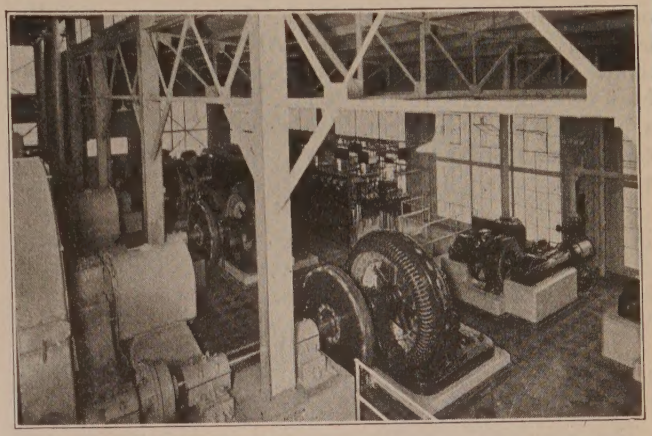
Grinding Department

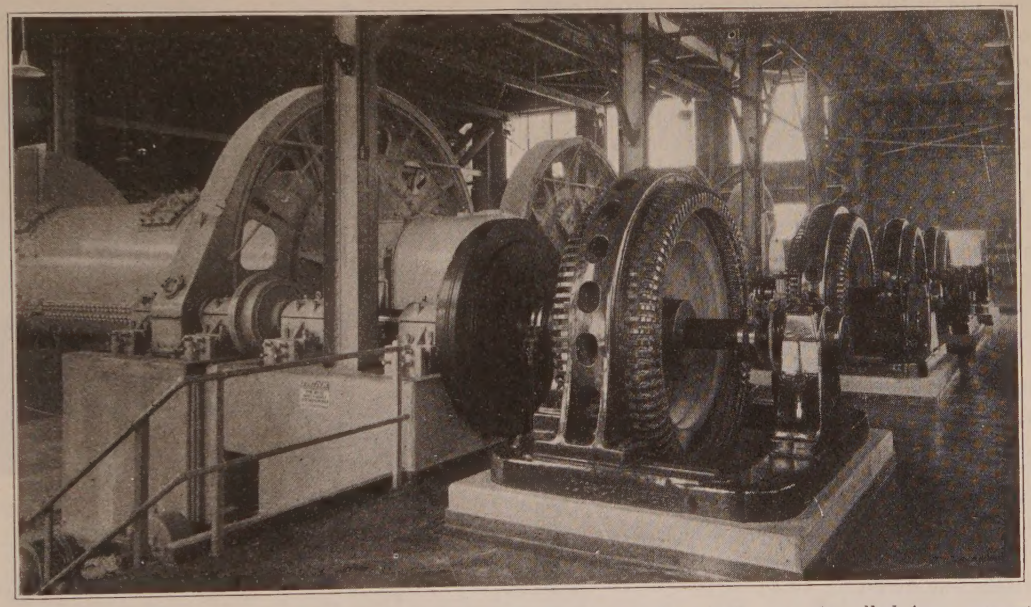
The grinding department building extends under the storage building for a little distance so that the cranes can pick up the materials and place them into the bins over the mills.

There are four bins—one over each tube mill. Each bin is divided into two compartments. In the raw end one side holds limestone and the other shale. In the fin-

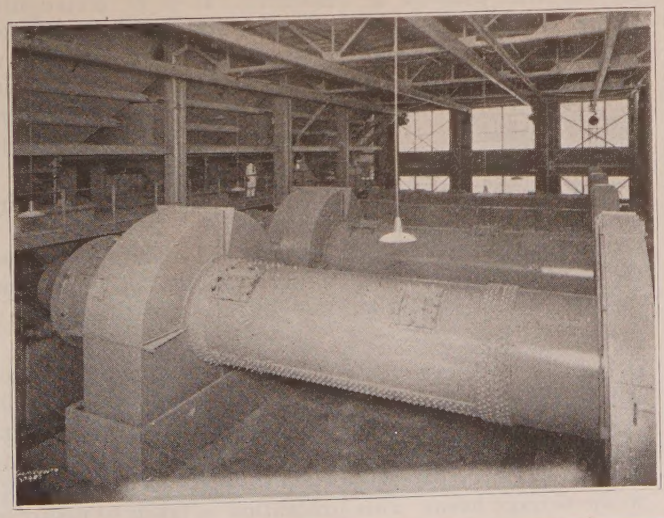
The Grinding Department

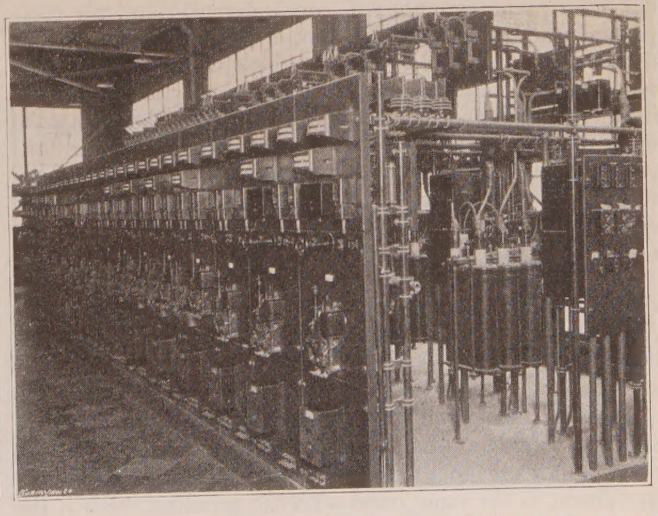






Some views of the grinding room. It contains the largest grinding mills ever installed in a cement plant. So clean is it that the motors driving the kilns and the main plant switch board were installed in the same room





ish end one side holds clinker and the other gypsum. Each mill is fed by two Schaffer poidometers which proportion the materials accurately as they are fed to the tube mills. Here 35 per cent of water is also added.

The grinding department is of especial interest for several reasons. First of all, the grinding units are the longest mills in the United States. They were especially designed and manufactured by Allis-Chalmers for this plant. All of the four mills (two on the raw and two on the finish end) are 40 feet long. The first compartment is 9 feet long and 8 feet in diameter. The rest of the length—comprising the other two compartments—is seven feet in diameter.

Each mill is driven by an 800 hp. Allis-Chalmers synchronous motor through a 72-inch Cutler-Hammer magnetic clutch and a Falk flexible coupling. The speed of the raw mills is 21.8 r.p.m. That of the finish mills is 19.9 r.p.m.

Charges run from 4-inch forged steel balls to 5/8-inch slugs. About 65 tons of balls and cylpebs constitute a charge.

The finish mills grind from 110 to 115 barrels per hour and the raw mills about 100 barrels per hour.

While the raw and finish mills are of approximately the same design and of exactly the same size, there is a difference in the method of discharging from the first to the second compartments. The raw mills are equipped with peripheral discharge in the first compartment. The material, after it has passed through the first compartment, discharges into a sump from which it is picked up and placed into the second compartment. This equipment provides what is practically independent primary pulverizing. The finish mills are not equipped with this device.

Though the limestone used has been found difficult to grind by all the plants that use it, all the raw materials are ground to a fineness of at least 90 per cent through the 200-mesh sieve. This, with careful proportioning and thorough burning has been found to be an important factor in making quality cement.

Mill Room Illustrates Design Principles

In the mill room, perhaps more than in any other department, the application of the four design principles is evident. The long mills have been found to be extremely efficient in fine grinding and that is a necessity in both the raw and finish ends where a high quality of cement, such as was aimed for in this plant, is sought.

The grouping of machinery so as to cut labor cost is also strikingly illustrated. In the grinding room is also the main plant switchboard, two Ingersoll-Rand air compressors and two 435 hp. motor generator sets. Only three men are needed to operate these departments. They do everything in connection with the proportioning, grinding and handling the slurry, in addition to handling the work in the power house which is combined with the mill room. One man tends to the proportioning of the materials, another watches the electrical equipment and a third oils the machinery. The grouping of the machinery in this room is largely responsible for this low labor cost.

The large size of the grinding equipment has been shown to have a very important bearing on maintenance costs. Officials of the plant consider that oversize units in the grinding department are definitely responsible for a reduction in manufacturing costs.

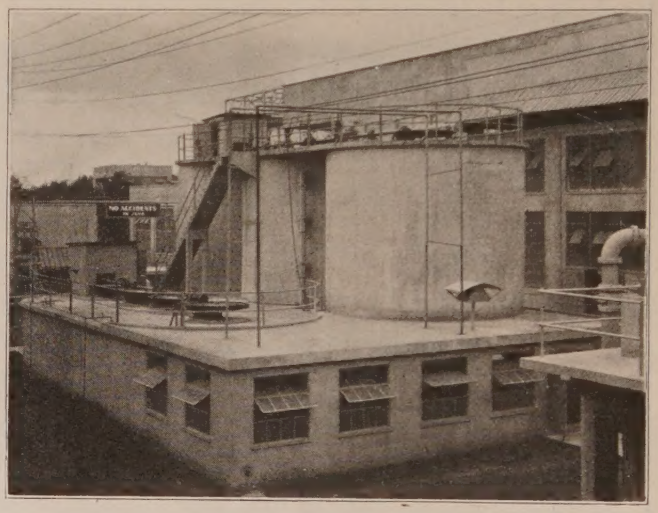
The attention given to the matter of appearance is here strikingly evident. In the first place, it would have not been practicable to place the motors and other electrical equipment in the same room with the grinding mills if the room were not made absolutely dustless. Here is an example of the influence of cleanliness on grouping of equipment and therefore on labor costs.

The mills are painted grey and the motors green. Rubber tiling is placed on the floor. The room is large and well lighted. So pleasant and clean are the surroundings that, except for the noise of grinding, it is difficult to realize that you are in the grinding room of a cement plant.

Dust collection is accomplished by a filter type Norblo dust collector.

Slurry Handling

Equipment for mixing and storing slurry is unusually complete. Underground pipe lines convey the slurry from the mills to the slurry correction tanks. There are three of these, built of reinforced concrete. Each tank is 20 feet in diameter and 20 feet high, providing storage for 700 barrels of slurry. Under these tanks and to one side is a large mixing basin, equal in capacity to the three correcting tanks. The slurry enters this large tank by gravity from the correction tanks. Here the slurry is tested and the proportions of the mix are again checked and



The three slurry correction tanks. Under them is a large slurry mixing basin

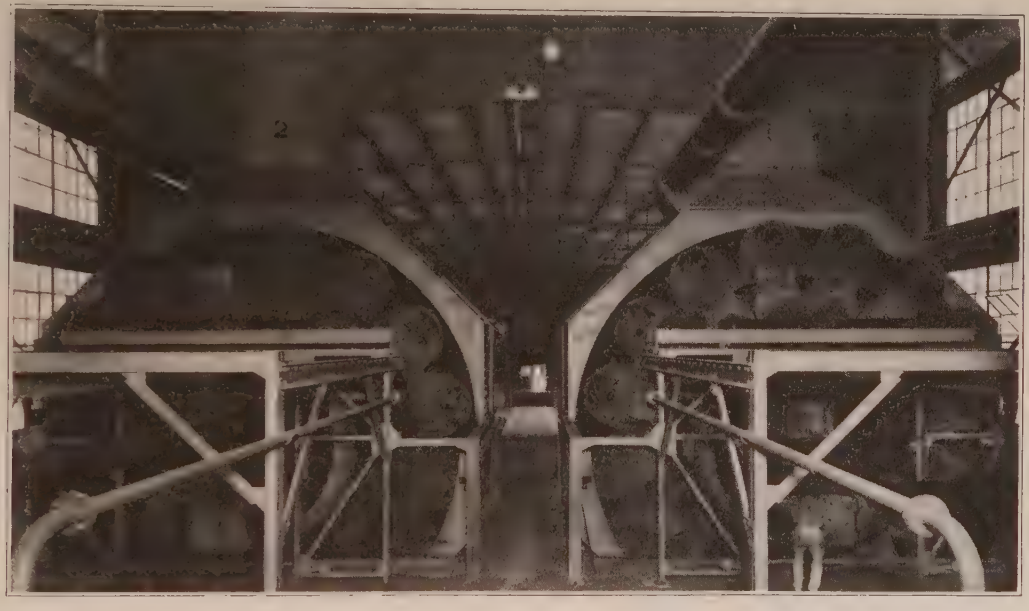
regulated. F. L. Smidth agitators are installed in all these basins. After the final corrections in the mix are made, the slurry is pumped by a Smidth air lift pump, using Ingersoll-Rand compressors, to the slurry storage basin.

This basin is of unusual design as far as American cement mill practice is concerned. It is of rectangular shape, built of reinforced concrete, 200 feet long, 40 feet wide and 25 feet deep. It is capable of storing slurry sufficient for a three or four days' run. This feature, with the constant agitating, assures a slurry of remarkably uniform composition. It was designed by F. L. Smidth and Company.

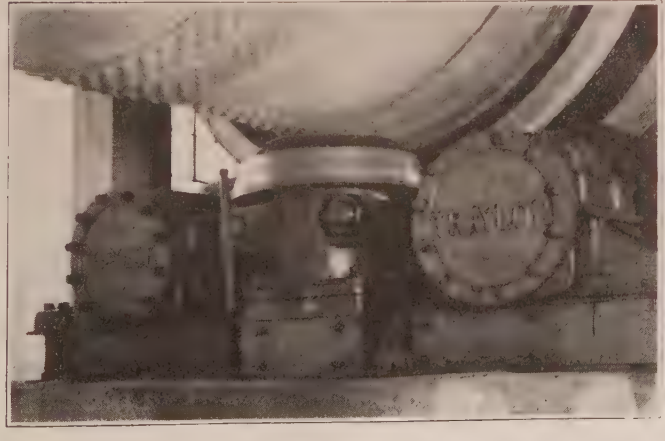
The slurry is kept agitated by an automatic traveling agitator, also of F. L. Smidth design. It consists of a structural frame that travels backward and forward over the length of the storage tank, continually supplying both mechanical and air agitation. Operation of this device is completely automatic.

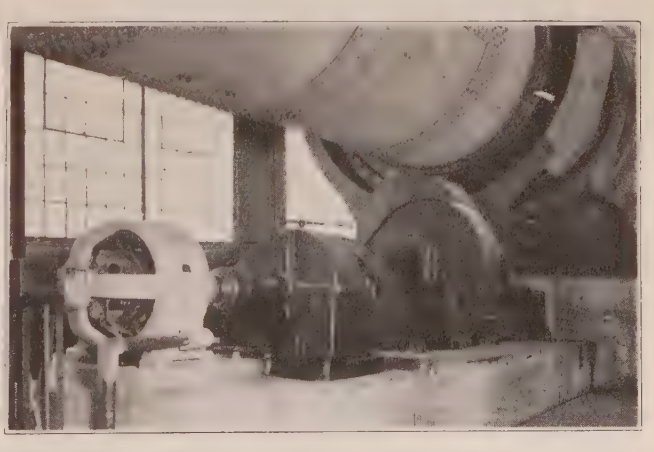
A long narrow sump receives the slurry from the storage basin. Two 4-inch Wilfley pumps convey it from this sump into the kiln feed boxes. The rate of flow is regulated so that the feed boxes are constantly overflowing, the excess slurry being returned through an overflow pipe to the storage basin. This precaution is taken to assure an absolutely uniform feed to the kilns.

The Kiln Department



The kilns are 343 feet 9 inches long, supported on 5 single roll supports. Only 60 hp. is needed to drive them. Thrust is taken up at the middle of the kiln as shown in the lower left hand illustration. The double tube Unax coolers, the only ones of their kind in the world, are shown in the center illustration





The slurry storage basin is of rectangular shape, 200 feet long, 40 feet wide and 25 feet deep. An automatic traveling agitator operates on rails on top of the tank. The basin is of unusual design so far as American mill practice is concerned

Smidth-made ferris wheel type feeders supply the kilns with slurry. These operate at speeds between 600 and 1200 r.p.m. and are driven by a direct current motor through a Falk speed reducer.

The Kilns

The kiln department is of exceptional interest because of the problems arising in the design and installation of kilns of such great length and also because of the use of some new units of equipment that have never before been used in this country. Here again is an illustration of the economies effected by large units of equipment and their effect on the quality of the product.

The kilns, designed by F. L. Smidth & Company, and fabricated by the Traylor Engineering and Manufacturing Company, are 343 feet 9 inches long. The diameter is 11 feet, 3 inches in the burning zone for the first 120 feet and 10 feet for the rest of the length.

Each kiln weighs 550 tons and is carried on five single roll supports. Only 60 hp. is required to drive the kilns, though they are powered by 100-hp. direct current motors. Single roll supports with large bearings, cut steel gears and careful balancing of the huge kilns are responsible for the low power consumption. The thrust is taken on the third support so that the six inches of expansion in the kiln will be taken up at both ends.

In the feed end of the kiln there are 5000 feet of 7/8-inch chain looped on the inside surface for a length of about 120 feet. These assist in heat transfer and also prevent ring formation. They also act as dust collectors. This feature, patented by F. L. Smidth & Company, is in use in European plants but has not been used heretofore in American mills.

Arcofrax, high alumina fire brick, is used for lining the burning zone of the kilns. The feed end is lined with a 3-inch Danish brick covered with a 6-inch ordinary fire brick.

Two duplex conoidal fans, manufactured by the Buffalo Forge Company, were installed to control the kiln draft. A fresh air damper, which is automatically controlled, was installed to admit air for lowering the temperature of the gases before entering the fans. The draft first passes through a steel dust collecting chamber and then through the stack. Under the chamber are screw conveyors for removing the dust.

Great care is exercised in burning the clinker as this is recognized to be one of the crucial operations in making cement of high quality. The long kilns were found to be particularly efficient. The material is in the kiln for six hours as against about 2½ hours in many of the shorter kilns. Every possible bit of heat is utilized for burning the clinker. This is shown by the exceptionally low exit gas temperatures which are only from 500 to 700 degrees. The capacity of 2,000 bbls. per day for each kiln is easily maintained.

A close check is kept of the exit gas temperatures. Thermocouples placed at the mouth of the kiln record the temperatures constantly. An indicating pyrometer on the burning platform and a graphic recording pyrometer in

the superintendent's office indicate the performance of the kilns at all times. A kiln control board, that indicates every kiln operation and provides remote control of every operation, was installed on the burner's platform, giving him absolute control of the burning process.

First Double Tube Coolers

For some time European cement plants and one American plant had kilns equipped with single tube "Unax" coolers, but the double tube installation at the Phoenix plant is the first one of its kind in any plant. The equipment was designed and manufactured by F. L. Smidth & Company.

The cooler consists of two concentric rows (16 in each row) of circular tubes placed around the diameter of the kiln at the discharge end. Each cooler tube is 14 feet long and 3 feet in diameter.

A series of holes in the lower end of the kiln shell permits the hot clinker to fall into the tubes in the inside row of coolers. As the kiln revolves, the clinker works its way back through the coolers and is then discharged into the outside row. The clinker now passes forward through the outside cooler and is discharged onto a "Skipulter" shaking conveyor and carried to storage. Clinker leaves the kiln at about 2200 degrees and leaves the coolers at 220 degrees.

Each tube of the cooler contains loops of chain similar to the chain in the kiln previously described. These chains facilitate the transfer of the heat from the clinker to the air forced through the cooler. This preheated air then enters the kiln, increasing the kiln efficiency. Even the air used for blowing the coal into the kiln is taken from the top of the coolers so that as little as possible of the kiln heat needs to be used in heating the air in the kiln.

Coal Room

Coal is received in bottom dump cars on a switch track located between the coal building and the storage building. A track hopper under this track extends into the storage building in the space allotted for coal storage. With this arrangement, it is possible for the storage building crane either to take coal from the track hopper or to load coal into it.

A Bartlett and Snow automatic skip hoist picks up the coal and dumps it into a 100-ton bin at the top of the coal building. From here the route of the coal is downward by gravity through the dryers and mills. The skip hoist is entirely automatic in operation and when the bin above is filled, the overflow returns to storage.

The coal is dried in two Fuller-Randolph vertical type dryers, each of 6 tons capacity per hour. The coal drops from the storage bin into a center compartment and hot gases (250 deg.) are drawn through the coal at the rate of 15,000 cubic feet per minute. This treatment dries the coal so that only ½ of 1 per cent of moisture is present. A furnace with an automatic stoker heats the gases.

From the dryers the coal is fed to two 46-inch Fuller Lehigh mills after which a Fuller-Kinyon pump conveys it to the bins on the burning floor.

Finish Grinding and Storage

Clinker is ground to a fineness of about 88 per cent through the 200-mesh sieve in the two finish grinding mills previously described.

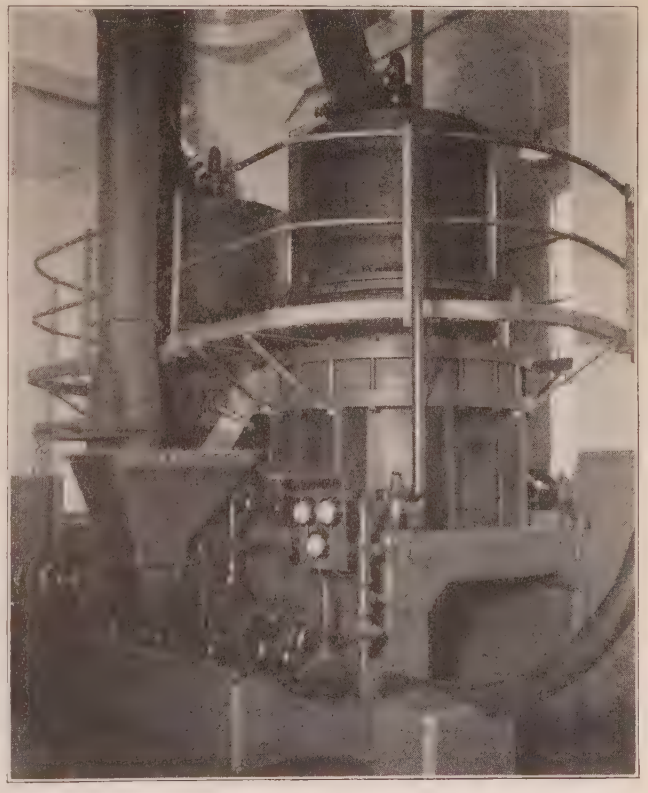
The mills discharge the cement into a trough where a 14-inch screw conveyor carries it to a second similar conveyor. This feeds two 6-inch Fuller-Kinyon pumps which transport the cement to storage.

Storage capacity for 160,000 barrels of cement is provided. There are 12 circular silos, and one rectangular silo compactly grouped. Ten of these silos are 25 feet

The vertical type Fuller-Randolph coal dryers have a capacity of 6 tons per hour, each

in diameter and 80 feet high. These are placed in two parallel rows, five silos in each row, on either side of the rectangular silo. Two other silos, 16 feet in diameter and 80 feet high, close in the ends of the rectangular silo, completely surrounding it with circular silos.

Three parallel lines of screw conveyors, running along the long dimension of the bins, reclaim the cement from storage and feed two cross conveyors. These in turn,



Two 46-inch Fuller-Lehigh mills pulverize the coal

feed two chain elevators that feed packer bins. There are four three-tube Bates packers. Packhouse and baghouse are made as clean and dustfree as the mill room and the coal room by Norblo dust collection installations.

There is storage capacity for 160,000 barrels of finished cement

Plant Buildings

All buildings except the coal mill and the auxiliary building are of structural steel frame with gunited walls and flat concrete roof slabs. The coal mill, silos and slurry mixing tanks are of reinforced concrete constructed with slip forms. The big slurry storage tank is of reinforced concrete built with fixed forms.

The auxiliary building, 346 feet by 60 feet, which houses the plant office, the drafting room, washrooms, electrical shop, storage rooms, machine shops, blacksmith shops, and laboratory, is built of slag concrete block covered with gunite. The roof is of flat concrete tile, covered with a Barrett Specification roof.

In the front of this building is the office. Beyond that is the drafting room, the washrooms, the shops and storage rooms and at the far end, the laboratory. The location of the laboratory, as has previously been noted, is within 100 feet of all the principal control points.

The laboratories are completely and modernly equipped with furniture and apparatus selected and arranged by R. E. Roscoe, the supervising chemist of the corporation. In addition to the equipment needed for controlling the quality of cement, the physical laboratory is provided with testing machines which will enable the company to render valuable service to its customers. For this purpose a 200,000 lb. Riehle testing machine was installed.

Personnel

All of the officials now operating the mill have had important parts in planning and constructing it. They have seen the design take form as they fit it to meet the four ideals constantly before them. They have superintended the erection of the buildings and the installation

The plant office

of the equipment. And now they are seeing the actual performance of the mill that not so long ago was merely the dream of the builders.

From the president of the corporation down, every man takes a just pride in the mill and its accomplishments. Most of the men have helped to build the plant. There is practically no labor turnover.

The plant has proved the value of the principles held in its design. It has proved that better plants can be built at reasonable costs. As it now stands this plant is an inspiration to other cement manufacturers—a new mark to shoot at. It definitely marks an important step forward in cement plant design and operation. It supplies the purchaser with a better product than it is bound by specifications to offer and by so doing it builds up the good will of the buyer and promotes the uses of concrete.

Lindley C. Morton is president of the Phoenix Portland Cement Corporation which owns and operates this plant and another one at Nazareth, Pa. R. J. Hawn is vice-president in charge of the two plants. H. O. Underhill is superintendent of the Birmingham plant; R. E. Roscoe is supervising chemist of both plants; S. C. McCurdy is sales manager; G. D. Youell is master mechanic and C. E. Phillips is mill foreman.

Two views of the attractive plant laboratories

Interpreting Cement Analyses

A Mathematical Method of Calculating the Potential Constitution of Cements With Tables for Making Rapid, Accurate Calculations

IN the July issue of the Mill Section of Concrete an article by W. E. Haskell of Oakland, Calif., presented a graphic method of ascertaining the percentages of $3CaO.SiO_2$, $2CaO.SiO_2$ and $3CaO.Al_2O_3$ in a given sample of cement.

A prominent engineer, experienced in cement technology, who for certain reasons prefers not to use his name in this discussion, contributes the following mathematical method and tables by means of which calculations of the potential constitution of any cement can be rapidly and easily accomplished.

THE chemical analysis of a cement, as usually expressed in terms of the oxides of the minerals present, is not an expression of the values that directly suggest the character of the cement in question.

Consequently, those who deal frequently with such data, have adopted the use of various "Ratios" and "Indexes," derived from certain of the values as reported in the analysis, in an effort to interpret the data into significant terms.

The necessity for employing such means of interpretation of course lies in the fact that the minerals of which the cement is composed do not exist therein as simple oxides at all, but, as sundry and rather complex compounds.

The nature of these compounds has been the subject of much study, and while there still exists some doubt and controversy over minor details, their general constitution has been fairly well established.

This is at least true to the point that it has been shown that a mechanical mixture of individually prepared pure compounds similar to those that are believed to exist in portland cement does possess the properties of commercial, prepared portland cement itself.

It is not within the scope of this memorandum to attempt to discuss in detail the observed characteristics of all of these compounds or their mutual influence when mixed in varying proportions; the subject is dealt with in Technologic papers of the Bureau of Standards and elsewhere, and further extensive studies are in progress.

If we are to take advantage of such research work by applying it, insofar as that may be possible, to studies of the commercial product, it is obvious that the first step should be to consider the composition of a cement in terms of the compounds that are likely to be present.

The proportions of these various compounds actually present in a commercial cement will be limited, not only by its chemical composition, but also by the conditions of its manufacture, to the extent that these conditions may have been favorable or otherwise to the formation of the compounds from the elements present.

The fineness to which the raw materials have been ground before burning, and the temperature and period of burning are the chief factors involved in accomplishing these desired combinations.

Chemical analysis affords no indication of the extent to which these combinations have been actually effected, so that any calculations of the probable constitution of a cement, based on its chemical analysis must necessarily be based also on the assumption that manufacturing processess have been effectively carried out. The necessity for such an assumption is one serious handicap to the study of cements that has not yet been overcome; which does not appear to be any reason why we should not make what limited use we can of the information that is at our disposal.

If we cannot determine positively the constitution of a particular cement we can at least calculate its potential constitution from its chemical analysis and so be dealing with more directly significant terms than those of the mineral oxides.

A = % SiO_2 – Ins. Res.

B = % Al_2O_3 × 1·65

Al_2O_3	B	Al_2O_3	B	Al_2O_3	B	Al_2O_3	B	Al_2O_3	B	Al_2O_3	B
5·0	8·3	6·0	9·9	7·0	11·6	8·0	13·2	9·0	14·9	10·0	16·5
·1	·4	10·1		·7		·4		15·0		·7	
·2	·6	·2		·9		·5		·2		·8	
·3	·7	·4		12·1		·7		·4		17·0	
·4	·9	·6		·2		·9		·5		·2	
·5	9·1	·7		·4		14·0		·7		·3	
·6	·2	·9		·5		·2		·8		·5	
·7	·4	11·1		·7		·4		16·0		·7	
·8	·6	·2		·9		·5		·2		·8	
·9	·7	·4		13·0		·7		·3		18·0	

C = % Fe_2O_3 × 0·7

Fe_2O_3	C	Fe_2O_3	C	Fe_2O_3	C	Fe_2O_3	C	Fe_2O_3	C	Fe_2O_3	C
0·0	0·0	1·0	0·7	2·0	1·4	3·0	2·1	4·0	2·8	5·0	3·5
·1	·1	·8		·5		·2		·9		·6	
·2	·1	·8		·5		·2		·9		·6	
3	·2	·9		·6		·3		3·0		·7	
·4	3	1·0		·7		·4		·1		·8	
·5	·4	·1		·8		·5		·2		·9	
·6	·4	.1		·8		·5		·2		·9	
·7	·5	·2		·9		·6		·3		4.0	
·8	·6	3		2·0		·7		·4		·1	
·9	·6	3		·0		·7		·4		·1	

D = % SO_3 × 0·7 USE ABOVE TABLE.

The compounds that have been identified as existing in portland cement are as follows:

$3CaO.Al_2O_3$ —Tricalcium Aluminate.
$2CaO.Fe_2O_3$ —Dicalcium Ferrite.
$2CaO.SiO_2$ —Dicalcium Silicate.
$3CaO.SiO_2$ —Tricalcium Silicate.
$CaSO_4$ —Calcium Sulphate.
MgO —Magnesium Oxide.

There are usually also present minor quantities of the oxides of sodium and potassium, and some insoluble silica.

$E = A \times 1.87$

A	E	A	E	A	E	A	E	A	E	A	E
18.0	33.7	19.0	35.5	20.0	37.4	21.0	39.3	22.0	41.1	23.0	43.0
.1	.9	.7	.6	.5	.3	.2					
.2	34.0	.9	.8	.6	.5	.4					
.3	.2	36.1	38.0	.8	.7	.6					
.4	.4	.3	.2	40.0	.9	.8					
.5	.6	.5	.3	.2	42.1	.9					
.6	.8	.7	.5	.4	.3	44.1					
.7	35.0	.8	.7	.6	.5	.3					
.8	.2	37.0	.9	.8	.6	.5					
.9	.3	.2	39.1	41.0	.8	.7					

A	E	A	E	A	E
24.0	44.9	25.0	46.7	26.0	48.6
.1	45.1	.9	.8		
.2	.2	47.1	49.0		
.3	.4	.3	.2		
.4	.6	.5	.4		
.5	.8	.7	.6		
.6	46.0	.9	.8		
.7	.2	48.1	.9		
.8	.4	.2	50.1		
.9	.6	.4	.3		

$F = \%CaO - (B+C+D+E)$

The potential constitution of a cement in terms of the above compounds can be conveniently calculated from its chemical analysis as follows:

Let A = % SiO_2 less insoluble residue.
B = % $Al_2O_3 \times 1.65$ CaO combined as $3CaO.Al_2O_3$.
C = % $Fe_2O_3 \times 0.70$ CaO combined as $2CaO.Fe_2O_3$.
D = % $SO_3 \times 0.70$ CaO combined as $CaSO_4$.
E = A × 1.87 CaO combined as $2CaO.SiO_2$. (initially).
F = % CaO — (B + C + D + E) CaO available to combine with $2CaO.SiO_2$ to form $3CaO.SiO_2$.
Then G = 4.07 × F = % $3CaO.SiO_2$.
H = A + E + F — G = % $2CaO.SiO_2$ (ultimately).
K = B + % Al_2O_3 = % $3CaO.Al_2O_3$.
L = C + % Fe_2O_3 = % $2CaO.Fe_2O_3$
M = D + % SO_3 = % $CaSO_4$.

As an example of the application of this principle to the study of cements, the following analyses of two brands of portland cement will be briefly considered:

CHEMICAL ANALYSIS

	Brand A	Brand B
SiO_2	20.0	22.9
Al_2O_3	6.7	6.6
Fe_2O_3	2.7	2.2
CaO	63.6	63.2
MgO	4.3	2.4
SO_3	1.4	1.6
Loss on ignition	1.3	1.1
Insoluble residue	0.4	0.3

POTENTIAL CONSTITUTION

Tricalcium Silicate	52.5	30.1
Dicalcium Silicate	16.7	42.2
Tricalcium Aluminate	17.8	17.5
Dicalcium Ferrite	4.6	3.7
Calcium Sulphate	2.4	2.7
Magnesium Oxide	4.3	2.4
Insoluble Silica	0.4	0.3
Moisture and CO_2	1.3	1.1
	100.0	100.0

If we now refer to the observed properties of these compounds, as noted by authorities who have studied them, we find the conclusion drawn that it is the tri-

(Continued on Page 112)

$G = F \times 4.07$ = % TRICALCIUM SILICATE.

F	G	F	G	F	G	F	G	F	G	F	G
3.0	12.2	4.0	16.3	5.0	20.4	6.0	24.4	7.0	28.5	8.0	32.6
.1	.6	.7	.8	.8	.9	33.0					
.2	13.0	17.1	21.2	25.2	29.3	.4					
.3	.4	.5	.6	.6	.7	.8					
.4	.8	.9	22.0	26.1	30.1	34.2					
.5	14.3	18.3	.4	.5	.5	.6					
.6	.7	.7	.8	.9	.9	35.0					
.7	15.1	19.1	23.2	27.3	31.3	.4					
.8	.5	.5	.6	.7	.8	.8					
.9	.9	.9	24.0	28.1	32.2	36.2					
—	—	—	—	—	—						
9.0	36.6	10.0	40.7	11.0	44.8	12.0	48.8	13.0	52.9	14.0	57.0
.1	37.0	41.1	45.2	49.2	53.3	.4					
.2	.4	.5	.6	.7	.7	.8					
.3	.9	.9	46.0	50.1	54.1	58.2					
.4	38.3	42.3	.4	.5	.5	.6					
.5	.7	.7	.8	.9	.9	59.0					
.6	39.1	43.1	47.2	51.3	55.4	.4					
.7	.5	.5	.6	.7	.8	.8					
.8	.9	44.0	48.0	52.1	56.2	60.2					
.9	40.3	.4	.4	.5	.6	.6					

$H = (A+E+F) - G$ = % DICALCIUM SILICATE.

Nomenclature and Descriptions of the Special Cements

A Proposed Classification of the Various Cements Now Being Manufactured and Sold

By EDWIN C. ECKEL

Several articles appearing in the April issue of "Concrete" give point to a discussion, at this time, of the types and nomenclature of the various special cements which are now on the market, and of such types as may reasonably be expected to appear in the near future. Since there is already a certain variance in usage on the point of names for these special cements, it would seem advisable, from any standpoint, that we put some limit on the possibility of misunderstanding and confusion by agreeing on their nomenclature at least. We may still retain widely different views as to the technical or the economic value of any particular type; but we will agree on what type it is that we are discussing in any particular case.

The present article is an attempt to clarify the situation a little, by naming the various types and giving a brief description of each, merely sufficient to justify the name chosen for the group. It is, moreover, an attempt to do this without bringing into controversy the merits of the products themselves. All we are concerned about at present is that each type should have one broadly accepted group-name, as distinct from any possible trade mark name which makers may select for any particular brand of that group.

THERE are at present eight general types of cement on the American and European markets. Of these three are old-established types whose description is well-known and whose nomenclature is well fixed in the trade, while the remaining five are of more modern origin and of less well-established classification. Since it has been these last five which have shown the greatest growth in late years, they are the ones which are in need of definite classification and naming. In the present article they will be distinguished under the following names:

I. *Normal Portland Cement.*

I.a. *Accelerated Portland Cement.*

I.b. *Mixed Portland Cement.*

II. *Alumina Cements.*

III. *Normal Natural Cements.*

III.a. *Mixed Natural Cements.*

IV. *Normal Slag Cement.*

IV.a. *Accelerated Slag Cements.*

Some of these classifications need discussion, but before going on to that, the entire matter may be summarized briefly as follows:

The characteristics of Types I, II, III and IV are commonly understood, and can be found in any modern textbook or trade manual. The characteristics of I.a., I.b., III.a. and IV.a. are less well-known. In the cases of I.a. and IV.a. the treatment is adopted to secure greater speed in hardening. In the cases of I.b. and III.a. the treatment is in general adopted to secure some *other* technical property, such as increased plasticity without any notable increase in speed or in strength. It will be seen that while all of these may fairly be called "Special Cements," their specialization tends in widely different lines—which is the reason for trying to secure agreement in nomenclature before the matter becomes too complicated or too badly involved in trade interests.

The few notes needed to clear up any doubtful points in this system of classification and nomenclature may now be taken up, in the order named above.

I. Normal Portland Cement

This product is already subject to very clear definition in various standard specifications. Normally it is made to just pass such specifications. Any disturbance in its quality or other features will result in acute trade disturbance and a resumption of the unhappy financial conditions of 1908-1915. It may, therefore, be assumed that we will always have a very large tonnage of strictly normal portland cement whose quality and properties vary only slightly and within present accepted limits.

I.a. Accelerated Portland Cements

These are portland cements made with high lime, normally with high silica also,—with very fine raw grinding, very hard burning and with very fine finished grinding. Under these conditions they require additional chemical control of the mix. It is doubtful if this can be secured with a dry process. The clayey component of the mix must be low in alumina and low in iron oxide, or otherwise chemical control becomes too difficult for profitable operation. When properly made, the accelerated portlands show higher strength than normal portlands in short-time tests. They should be marketed under different specifications. In Europe, where most mills now make accelerated brands, the accepted trade practice has been to prefix "Super" to the old brand name; i. e., "Super-Flambeau," etc.

It might be noted here that certain European mills have tried to meet alumina cement competition in another way, i. e., by burning, at rather low temperatures, low-lime mixtures of normal portland cement mix plus alumina in one form or other. If such mixtures reach commercial importance at any time, which seems doubtful at the moment, they should be sharply distinguished both from the accelerated portlands and from the alumina cements.

I.b. Mixed Portland Cements

Mixed portland cements are portland cements of the normal type to which some additional ingredient is added, either at the mill or on the work, in order to secure some new and advantageous property—usually increased plasticity. If the added material is put in on the work, the cement as it leaves the mill will still be the old brand of standard or normal portland, and will need neither a new name nor new specifications. But if the cement mill adds the mixture itself, entirely new conditions will be introduced, and a new brand name should be selected or the old name modified. Even with all care in this respect, this particular line of development—i. e., mixed portlands—seems likely to land us back in the old happy days when Dragons became Paragons overnight.

II. Alumina Cements

This class includes cements made by fusion and depending for their most valuable properties upon a very low lime content and a rather high alumina content. The valuable properties are (a) quick-hardening and (b) chemical resistance. These two do not *necessarily* go together, a fact which is commonly overlooked. The choice of a group name for this rapidly growing type lies between "alumina cement," "aluminate cement," and "aluminous cement." Different writers have used each as a broad group term. My own preference happens to be for the one used here. Such terms as *Fondu*, which merely means *melted*, have become associated in the European mind with one particular brand—Lafarge's Fondu. And the name Lumnite, often used here as a group name, is, of course, so used in error, being merely the trade mark name of a particular brand.

Among the alumina cements there are two broad classes, technically and chemically considered, depending chiefly on the use of a rotary or a furnace in manufacture. There seems to be no good reason, at the moment, to introduce sub-names for each of these classes. What is needed, of course, is the general adoption of one term for the whole group of alumina cements, and the preparation of definite specifications for all of that group.

III. Normal Natural Cements

These were formerly well-known products, made by burning at relatively low temperature, a naturally clayey limestone, without previous grinding and mixing. They are usually low-limed as compared with portland, often high-magnesia also, always higher in clayey components. They are marked by rapid set and slow hardening, as compared with portlands. As a class, they reached their maximum of importance several decades ago, and are now revived as a consequence of their use in a mixture as below.

III.a. Mixed Natural Cements

Natural cements are those with which certain varying ingredients have been mixed at the mill, in order to secure valuable properties, notably increased plasticity. The two brands best known on the American market (where they exist alone) are Speed's Brixment and Lawrence's Hy-Test Cement.

The Bureau of Mines seems to have definitely adopted the group name *masonry cement* for these mixed naturals. If they are made with a chief view toward increased plasticity that is a very good group name. I am using the term mixed naturals merely to cover other possible developments in other lines. In any case the mixed portlands (I.b.) will compete with the mixed naturals (III.a.) and will have to be sold under similar trade conditions. If there is to be any standard specification for masonry cements it will have to allow for that condition—which almost reduces the case to an absurdity.

IV. Normal Slag Cements

These are cements made by mixing powdered slag, carrying around 50 per cent of lime, with quicklime or slaked lime. They are slow setting and slow hardening, but very cheaply made and more plastic than either portlands or naturals. They are therefore natural competitors with the masonry cements of either type I.b. or type III.a.

IV.a. Accelerated Slag Cements

Accelerated slag cements are made like normal slag cements, but with the addition of alkalies or other accelerating ingredients, usually added during the cooling of the slag, though sometimes during the use of the cement. Several European mills have taken up this line, and are making slag cements which set far more quickly than their own old normal slag cements. It is questionable if they are much better—if as good—as our own old steel cement and other brands made in similar fashion. My own view of possibilities along this line is still bearish, because at their best the accelerated slag cements still have to be sold as being "almost as good as portland"—which is not a hopeful line of argument. My feeling is that in the United States at least, the profitable line for slag mills is to develop their trade in competition with the masonry cement industry, depending upon the admitted plasticity and light color of the normal slag products. In that case what has been said above about masonry cement specifications will apply here also. We will, then, finally have a trade group comprising mixed portlands, mixed naturals, and normal or accelerated slag cements—all aimed at stucco and mortar uses.

Summary

The classification and nomenclature offered above was based, it will be seen, upon important differences in raw materials and modes of manufacture. As such it probably will be found broadly useful. But when we turn to consideration of possible specifications and trade associations, we see that there is a very probable cross-grouping, so that the final trade condition is likely to fall out as below, into four groups instead of eight. That grouping would be:

A. Brick Cements

Depending on plasticity, light color, cheapness, moderate strengths. Including in their trade group the slag cements, the mixed naturals and the mixed portlands. Specifications will be difficult; trade conditions even more so.

B. Normal Portland Cement

Already well-known and provided for.

C. Accelerated Portlands

Which by an increase of some 25 per cent in cost of manufacture will give notable increases in strength at three days or so; no additional chemical resistance (probably lessened, in fact, owing to high lime). Specifications are based on portland forms, but with higher requirements at shorter periods. Selling conditions are the same as portland, with price some 25 per cent in excess.

D. Alumina Cements

A highly specialized product, requiring special selling conditions and specifications.

EDITORIALS

Classification of Cements

AN article on another page of this issue raises the point that there is developing confusion in naming and classifying the various special cements now on the American market. There is already a certain variation in usage of names for these special cements.

Classification of the various cements now being manufactured and marketed and assigning each type to one particular group, without regard to its trade mark or brand would limit the possibilities of misunderstanding among the users. Already a degree of confusion has developed among cement purchasers regarding the types of cement available. They are inclined to define the type by the trade-marked or brand name rather than by a broad group name.

The article referred to attempts to clarify the situation by suggesting a proposed classification for these cements. This may or may not be the best or most satisfactory method of grouping the cements. The author presents his classification as a basis for discussion. Timely action in this matter will prevent much confusion and difficulty.

Behavior of Cement

AT a recent meeting of the American Society for Testing Materials, reported on another page of this issue, the question of the relation of the chemical composition of cement to its behavior in concrete occupied an important part in the program.

This is only one illustration of the increasing interest that users of cement are evidencing in cement quality and cement chemistry. They wonder why various cements behave differently when they are examined as to their concrete making qualities, even though the standard tests usually applied give little or no indication of difference. They wonder if there is not another way of measuring the quality of cement that will give a more accurate indication of what may be expected from the cement they purchase.

The chemical analysis of cement, as usually expressed in terms of the oxides of the minerals present, does not in itself give much indication of the character of the cement. It is difficult for the user to determine whether the cement in question will develop the qualities he is interested in.

The varying claims of the cement manufacturers for special qualities in their cements has encouraged this inquiring attitude in the user. He is beginning to wonder how the present specifications will provide a means of determining whether the cement he purchases will meet his purposes. He is learning to think of one brand as best suited for one purpose and another brand for another purpose.

The cement manufacturer is faced with the difficult problem of devising a more satisfactory measure of quality than the present specifications which take no account of some of the factors in cement behavior that the user has recently come to consider of great importance.

Cloth or Paper?

THE bag problem is as old as the cement industry. And it is not yet solved. Recently it has been forging into the foreground again to the extent that now it is as important—so one building material dealer said—as the prohibition question. Certain it is that the user of cement is considering and discussing the relative advantages of receiving his cement in cloth or in paper.

The problem is difficult because there are so many angles to it. The cement manufacturer must consider the preferences of the contractor, the products manufacturer and the building materials dealer as well as his own. And these preferences are not always identical. If they were, there would be no problem.

Very often the preferences of the building materials dealer and those of the user are at odds. If there is no additional cost to the user because he receives his cement in paper, it constitutes an item that must be considered in competitive bidding. The cost of cement is the largest single item in many concrete structures and when these compete with another material, even a slight additional cost for cement may turn the scale in favor of the competing material.

There has long been friction between the dealer and the contractor and products manufacturer over the matter of the dealer's differential. Now the dealers as a unit have gone on record as favoring the use of the paper bag. If the dealer is permitted to dictate still farther by fixing the type of container in which cement is to be shipped to the contractor and the products manufacturer, the old quarrel will be aggravated and little good will result.

It is not the object here to discuss the relative merits of the cloth and the paper bag. It is only suggested that the user of cement be permitted to choose for himself whether he prefers to pay a slightly higher price for cement packed in paper or whether he prefers to pay a price for taking care of and returning the cloth bags in which he receives his cement.

MEN and MILLS

Notes from the Field

Redwood City Plant Nearly Ready; New Dredge Acquired

Work is proceeding at a good clip on the second unit of the Pacific Portland Cement Company's plant at Redwood City, California. A double shift of mechanics is employed and completion is expected by the first of October. The present capacity of 2700 barrels will then be increased to 6000.

Thirty thousand acres of tideland and bay bottom are supplying the dredge at the present time. A giant, new, suction dredger "Texas" has been acquired to operate with the dredge "Golden Gate" in picking up the oyster shells.

Indiana Manager Also Appointed Vice-President

Mr. D. S. MacBride, at Indianapolis, Indiana, and manager of the Indiana Portland Cement Company, has been appointed vice-president and general manager, according to an announcement.

Mr. MacBride, before taking charge of the Indiana plant two years ago, was assistant general manager in the New York office of the International Cement Corporation. The Indiana plant is an International subsidiary.

Plans Ready Soon for White Cliffs Plant

The Lime Products Company, Little Rock, Arkansas, reports that financing of the proposed 500,000 bbl. cement plant at White Cliffs is now completed, and that plans for the wet process plant will be ready in about sixty days. No contracts have yet been awarded.

International Makes Further Reduction in Boston Area

The International Cement Corporation, through its subsidiary, the Knickerbocker Portland Cement Company, Inc., has announced a further reduction of fifteen cents a barrel in the price of its product within the switching area of Greater Boston.

Houston Trinity Plant Ready Soon

The new Upper Ship Channel plant of the Trinity Portland Cement Company will be ready for operation about September 1st. It is said to be probable that before construction operations are completed and while forces are still on the job, the decision will be reached to increase the proposed capacity of about 2000 barrels daily to approximately 3000 or 4000, at an additional cost of $500,000. This will bring the total plant expenditure to $2,500,000, or 20 per cent more than had been contemplated.

The average monthly payroll, since erection of the plant began, has been $35,000. During May it reached $48,000. About 400 men are employed daily in building the plant, and 60 or 75 will be required to operate it.

W. H. McCourtie is president of the Trinity Portland Cement Company, and C. E. Ulrickson is vice-president and general manager.

Sandusky Appoints Asst. Sales Manager

The Sandusky Cement Company, Cleveland, Ohio, has appointed Charles E. Jackson assistant sales manager. Mr. Jackson joined the firm in April, 1927, and was for many years a building contractor.

Ferguson Made Vice-President of Louisana Portland

The Louisiana Portland Cement Company has appointed Lewis R. Ferguson, manager, to the office of vice-president and manager. This appointment was effective July 1st.

Louisana Plant Limestone Arrives By Barge

Several barges of raw material arrived recently at New Orleans from Stephens, Alabama, quarries, for the Louisana Portland Cement Company. The latter has just started operation of its 2,200 bbl. per day plant.

Plans are already being made to increase the production 50 per cent.

Carolina Dividend Declared

A dividend on preferred stock of the Carolina Portland Cement Company was declared payable July 1st.

Volunteer Contract Awarded to Burrell

The Burrell Engineering Company of Chicago, Illinois, has been awarded the contract for the erection of the stock and pack houses of the Volunteer Portland Cement Company. Contracts for the main building are not to be let for several weeks. Machinery has been purchased.

Practically all grading for the plant is in its final stages and the railway sidings are being laid from the Southern Railway to the site.

Railroad Asks Decrease in Cement Rates

Application has been made by the Minneapolis and Omaha Railroad to the Nebraska state railway commission for permission to reduce its rates on carload lots of cement to imtermediate points between Superior and Sioux City, Iowa.

The present rate between Sioux City and Superior is 14 cents, while all intermediate points are charged higher rates. To Dakota City the rate is 15½ cents, while to the following intermediate points on the M. & O. line it has been 16 cents: South Sioux City, Coburn, Hubbard, Necord, Emerson, Thurston, Pender and Bancroft.

Superior Cement Company New Subsidiary

Articles of incorporations have been filed by the Superior Cement Company, a subsidiary of the Wellston Iron Furnace Company, at Superior, near Ironton, Ohio. The cement plant employs 250 men and improvements now under way are expected to be completed September 1.

The officers, as follows, are also the officers of the Wellston Iron Furnace Company: President, S. E. Stephenson; Vice-President, M. L. Stephenson; Treasurer, Joseph McGee; Sales Manager, F. E. Shepard; General Superintendent, John A. Blank, and Superintendent, Victor Deifenderfer.

New Louisana Sales Manager

Ben F. White has been appointed Sales Manager of the Louisiana Portland Cement Company, at New Orleans, Louisana, effective since July 1st.

Effective June Safety Campaign Cuts Accidents Three-Fourths

Fatalities Cut 85 Per Cent Over Last Year, With But One Death —Number of Days Free from Accident Also Increased

By J. ALTON REITZEL

That the June cement mill safety campaign brought results is shown in a number of figures tabulated from reports.

June of this year set a record of 135 plants without a lost time accident or fatality. Records of the same month in 1926 show twenty plants without a lost-time accident. The greatest number of accidents in a single day in the thirty-day period last year was 16, while this year it was five. Although one day in June of last year was free from accidents, five were similarly free this year.

"No Accidents. Work Safely Today," was adopted by this Kansas plant

June, 1926, saw 192 lost-time and six fatal accidents registered against the cement industry. June, 1927, witnessed only fifty lost-time and one fatal accident with more mills in operation and more men employed than last year. Accidents were reduced 73 per cent this year and fatalities were cut down five-sixths.

Computing mills in relation to accidents, the following results were found after the June drive: 17 mills had one accident each, four mills had two accidents, and seven mills had three or more mishaps. These accidents were divided among the various departments as follows: quarry 6, clay field 1, crushing 2, raw 5, burning 2, finishing 4 (one fatality), coal grinding 0, cement storage 0, packing 8, power 1, shops 1, railroad 1, yard 3, repair 2, construction 4. Other reports received did not cover the department in which the mishap occurred.

June was originally selected for the no-accident campaign because it is usually the month of greatest production, often exceeding the small months by a large percentage. It is the month of maximum operating pay roll and is one of the heaviest months of the year with respect to number of new men at work, volume of construction and repairs under way and volume of shipments.

One hundred and sixty-four safety flags were presented. At the end of June, 31 of these flags had been returned and 133 continued to fly.

In 1919, 67 mills reported and 48,743,357 man-hours were worked. During that year 2,119 accidents were recorded with 69.2 days lost per 100,000 man-hours worked and 38 fatalities were suffered by the industry.

In 1926, the number of mills reporting had jumped to 124, with 97,380,785 man-hours worked. Both the number of mills and quarries reporting and the number of man-hours worked had practically doubled. The number of accidents and amount of lost time had not doubled. Last year, 2,174 accidents occurred with a resultant 45.3 days lost per 100,000 man-hours worked and 45 fatalities. Accidents had been decreased practically 100 per cent from 1919 to 1926 when judged on the basis of workers and hours worked.

According to many safety committees in the mills and quarries, at least 95 per cent of the total number of mishaps are directly due to carelessness. And these committees claim that since this is true, at least 95 per cent of the accidents can be eliminated.

This plant went to the extent of having a billboard at the plant carry its slogan

Suspended above the roadway, this sign caught every eye

Huron Company Christens Great Lakes Steamer

The christening of the Huron Portland Cement Company's steel steamer, S. T. Crapo, took place July 7th at the Great Lakes Shipbuilding yards. The Crapo, named for Stanford T. Crapo, secretary-treasurer of the company, is 400 feet long and has a beam of 60 feet. The hold is 29 feet deep. She is equipped with a triple expansion engine of 2,000 hp. and has a speed of 13 miles an hour. The equivalent of 160,000 sacks of cement is her normal load. The ship is electrically equipped with three turbo-generators, will load in four hours and unload in ten hours. The building cost was slightly over $1,000,000. A crew of thirty-five men is required.

A few weeks will be required to finish the interior, after which the ship will travel light to Alpena, Michigan, and be put into service there August 15th.

Former Lehigh Sales Manager Joins Florida

Frank M. Traynor has become associated with the Florida Portland Cement Company of Tampa, Florida, as general manager and director of sales. Previous to this position he held that of vice-president and general manager of the I. E. Schilling Company, building supply dealers, Miami.

Before coming to Miami in 1925, Mr. Traynor was sales manager for the Lehigh Portland Cement Company in Birmingham, Alabama.

Dwight Morgan New Virginia Manager

Dwight Morgan has been appointed vice president and manager of the Virginia Portland Cement Corporation, at Norfolk, Virginia. He remains in charge of sales as sales manager.

Mr. Morgan succeeds H. E. Hilts, recently promoted to the position of manager of the Cuban Portland Cement Corporation.

Pacific Portland Makes Biggest Shipment

On June 29th the Pacific Portland Cement Company plant made the largest shipment in its history, when two steamers were loaded at the plant wharf at one time. The ships were two of the McCormick Steamship Company's vessels, the Silverado and the Edna. The two ships took on a combined cargo of 15,000 barrels of cement bound for points along the Pacific coast.

New Cumberland Plant Operates at One-Third of Capacity

The Cumberland Portland Cement plant at Cowan, Tennessee, is now in complete operation. Both white and gray cement are being produced.

Capacity of the plant is 2,200 barrels per day, but at present only 750 barrels is being produced.

Regional Safety Meeting Held at Detroit

A regional safety meeting was held at the Book-Cadillac Hotel at Detroit, Michigan, on July 12th, attended by cement mill and quarry representatives from Michigan, northern Ohio, and northern Indiana. The National Safety Council and the Red Cross co-operated with the Portland Cement Association in this meeting. The morning program was conducted by Col. Wm. M. Hatch, president of the Peerless Cement Company and chairman of the local committee. Recent progress in cement mill safety work was outlined by A. J. R. Curtis, assistant to the general manager of the Portland Cement Association. A. M. Williams, director of safety work for the Chrysler corporation, spoke on "Successful First Aid Work," and A. Moreau, of the American Red Cross, gave a practical demonstration of safety work.

Other speakers were John W. Boardman, vice-president of the Huron and Wyandotte Portland Cement Companies; O. J. Lingeman, vice-president of the Aetna Portland Cement Company; J. W. Koster of the E. I. du Pont de Nemours Company; G. H. Cam, power and safety engineer for the Canada Cement Company, and Eugene J. Brook, state labor commissioner.

New Illinois Manager for Indiana Portland

Herbert L. Smith has been appointed manager of the Illinois sales territory of the Indiana Portland Cement Company, at Champaign, Illinois. Mr. J. F. Gates is to fill Mr. Smith's former position as traffic manager of the firm at Indianapolis.

Shift Railroad for Cement Plant

The first step in building the $1,500,000 cement plant near Louisville, Nebraska, was taken recently when the Roberts Construction Company of Lincoln, Nebraska, began work on a mile of new roadbed to be used by the railroad adjourning the property. The present line will be used as a spur by the plant.

It is understood that the Ash Grove Lime and Cement Company has purchased several sections of land in the vicinity having extensive clay deposits. The plant is expected to be one of the largest in the country and to be ready for operation early in 1929.

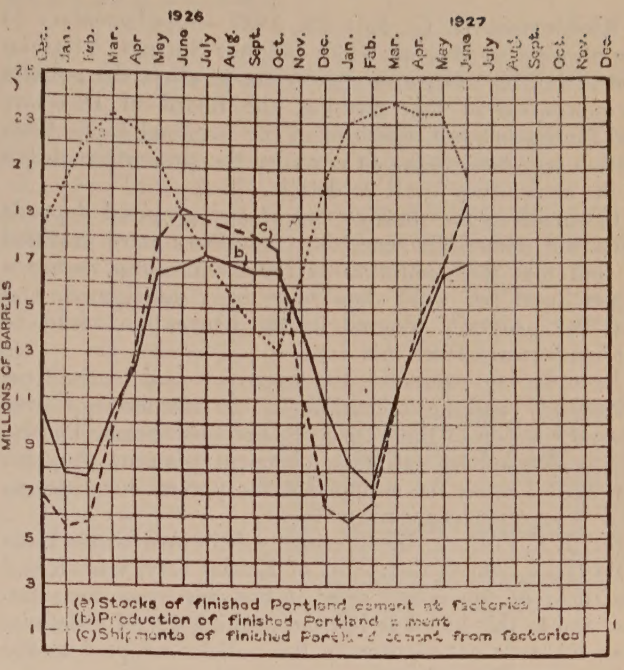
Atlas Distributes Lots to Employes

Hundreds of garden lots have been recently distributed among its employes by the Atlas Portland Cement Company at Northampton, Pa. This is a practice inaugurated during the war.

Cement Statistics for June

SHIPMENTS of portland cement in June are the greatest for any month in the history of the industry, and production for the month is slightly under and second only to that of July, 1926, according to the Bureau of Mines, Department of Commerce. Portland cement stocks show a seasonal decline but are nearly 10 per cent greater than the stocks at the end of June, 1926.

Production and shipments of portland cement for the first half of 1927 show increases respectively of over 4 and 5 per cent over the corresponding period in 1926.


1926
1927
Dec. Jan. Feb. Mar. Apr May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
MILLIONS OF BARRELS
(a) Stocks of finished Portland cement at factories
(b) Production of finished Portland cement
(c) Shipments of finished Portland cement from factories

Estimated Clinker (Unground Cement) at the Mills at End of Each Month, 1926 and 1927, in Barrels

Month	1926	1927
January	9,074,000	9,989,000
February	10,931,000	11,943,000
March	12,290,000	12,997,000
April	12,967,000	13,335,000
May	11,695,000	*12,488,000
June	10,144,000	10,840,000
July	8,604,000	
August	7,362,000	
September	6,112,000	
October	5,370,000	
November	5,748,000	
December	7,799,000	

*Revised.

Production, Shipments and Stocks of Finished Portland Cement, by Months and by Districts, in Barrels

Month	Production		Shipments		Stocks at end of month	
	1926	1927	1926	1927	1926	1927
January	7,887,000	8,258,000	5,674,000	5,968,000	20,582,000	22,914,000
February	7,731,000	7,377,000	5,820,000	6,731,000	22,385,000	23,560,000
March	10,390,000	11,452,000	9,539,000	11,083,000	23,236,000	23,922,000
First quarter	26,008,000	27,087,000	21,033,000	23,782,000		
April	12,440,000	14,048,000	12,965,000	14,350,000	22,710,000	23,654,000
May	16,510,000	16,674,000	17,973,000	*16,859,000	21,255,000	*23,482,000
June	16,866,000	17,078,000	19,134,000	19,716,000	19,000,000	20,844,000
Second quarter	45,816,000	47,800,000	50,072,000	50,925,000		
July	17,134,000		18,812,000		17,301,000	
August	16,995,000		18,583,000		15,718,000	
September	16,571,000		18,087,000		14,188,000	
Third quarter	50,700,000		55,482,000			
October	16,596,000		17,486,000		13,334,000	
November	14,193,000		11,276,000		16,243,000	
December	10,744,000		6,432,000		20,616,000	
Fourth quarter	41,533,000		35,194,000			
	164,057,000		161,781,000			

*Revised.

Commercial District	Production—June		Shipments—June		Stocks at end of June		Stocks at end of May, 1927*
	1926	1927	1926	1927	1926	1927	
Eastern Pennsylvania, New Jersey, Md.	3,956,000	4,091,000	4,629,000	4,745,000	3,967,000	4,394,000	5,048,000
New York	890,000	1,009,000	1,081,000	1,262,000	1,227,000	1,420,000	1,673,000
Ohio, Western Penn., and West Virginia	*1,665,000	1,716,000	*2,051,000	2,162,000	*2,310,000	2,953,000	3,400,000
Michigan	1,430,000	1,580,000	1,614,000	1,804,000	1,734,000	1,971,000	2,195,000
Wisconsin, Illinois, Indiana, and Kentucky	*2,397,000	2,387,000	*2,873,000	3,086,000	*2,980,000	2,432,000	3,131,000
Virginia, Tennessee, Ala., Ga., and La.†	1,468,000	1,414,000	1,411,000	1,357,000	1,125,000	1,203,000	1,146,000
Eastern Missouri, Iowa, Minn., and So. Dak.	1,545,000	1,467,000	*1,946,000	1,927,000	2,417,000	2,829,000	3,289,000
West. Missouri, Nebraska, Kan. and Okla.	1,129,000	994,000	1,105,000	976,000	1,454,000	1,743,000	1,725,000
Texas	416,000	469,000	454,000	454,000	478,000	330,000	314,000
Colorado, Montana, and Utah	311,000	268,000	289,000	233,000	369,000	551,000	516,000
California	1,281,000	1,315,000	1,305,000	1,294,000	502,000	594,000	573,000
Oregon and Washington	378,000	368,000	376,000	416,000	437,000	424,000	472,000
	16,866,000	17,078,000	19,134,000	19,716,000	19,000,000	20,844,000	23,482,000

*Revised. †Began producing June, 1927.

Lime Association Makes Plans for Future Activities

Washington, D. C., July 15, 1927—Supplementary to the meeting in May at White Sulphur Springs, Virginia, and following other meetings to put in effect the policies recommended at that meeting, the Board of Directors and the Executive Committee of the National Lime Association met here today to consider the present condition of the association in all its details.

Inasmuch as the working out of any proposal depends upon the assured income, the committees were gratified to find that the commitments for membership assure a larger fund for work than have been anticipated, and that the program adopted by the convention could be carried forward from this date.

In order to overcome the apparent undercurrent of uncertainty and apprehension in the membership ever since the action of the Board of Directors became known, it was decided to outline a clean-cut plan or program that would merit the support of the present members as well as prospective members.

Mr. J. F. Pollock, vice-president of the Ash Grove Lime & Portland Cement Company, of Kansas City, was elected chairman of the board after it had surveyed the situation and to this board is left the working out of a definite plan to carry out vigorously the policies adopted at the May convention.

This plan will naturally provide for immediate assurance of a headquarters office force sufficient to support the individual efforts of members, and the collective efforts of groups as they are organized, as well as the continuance of general association literature and considerable help on specific problems. A general meeting held to consider the welfare of the industry will naturally take place as soon as representation of the entire industry has been secured, preceded undoubtedly by meetings for each group to insure unity of action in these groups previous to the general meeting.

Further definite announcement will be made as rapidly as the financial and operative methods are worked out to support the general plan which is now being clearly defined.

Home Demand Causes Slump in Japanese Exports

Japanese cement exports have not been maintained actively. Last year's exports totaled 2,000,000 barrels, breaking all previous records. Cement companies turned their attention to export last year, due to a slack demand at home. In January, exports totaled 180,000 barrels, but they dropped to 137,000 barrels in February. Exports are expected to fall further to about 90,000 barrels for March. It is no longer necessary to concentrate energy on export, as demand is increasing at home.

Japanese Establish Two New Cement Firms

The Hidaka Portland Cement Company, capitalized at 10,000,000 yen, a quarter paid up, is one of the two Japanese cement companies established during March. The factory will be erected in Hidaka Province of the Hokkaido. The company is inviting subscriptions of shares numbering 200,000 at 50 yen per share. The other is the Nanao Portland Cement Company, affiliated with the Iwaki interests. The capitalization is 10,000,000 yen.

Motion Picture Tells Story of Electric Detonator

"The Story of the Electrical Detonator" is depicted in a new educational motion-picture film just completed by the United States Bureau of Mines, Department of Commerce, in cooperation with one of the large explosives manufacturing concerns. The film shows in graphic detail the methods of manufacture and use of this modern and highly practical device for the firing of explosives.

This is the latest of a series of approximately 50 educational motion-picture films prepared by the Bureau of Mines and cooperating agencies for the purpose of visualizing different phases of the mineral industries of the United States. This film is now available for exhibition by schools, churches, clubs, civic bodies and other organizations. No charge is made for the loan of the film, the exhibitor being asked only to defray transportation charges. Copies of the film may be obtained by addressing the United States Bureau of Mines Experiment Station, Pittsburg, Pa.

Interpreting Cement Analyses

(Continued from Page 104)

calcium silicate in portland cement that should be credited with the development of cohesive strength in mortars at early periods, but that at periods beyond 28 days the dicalcium silicate gains sufficiently in strength to place it almost on an equality with the tricalcium silicate.

It could be expected, therefore, that Cement A would develop much higher strength at early ages than Cement B, but that the ultimate strength developed by B would probably equal or exceed that of A.

This happens actually to have been the case with the two cements in question, Cement A being known as a "High Early Strength Portland" developing nearly twice the strength at seven days that is developed by Cement B, which is a portland cement of normal physical characteristics.

Other properties of the possible constituents of the cements may well be the subject of consideration besides that of their strength development. It may be noted, for instance, that both tricalcium and dicalcium silicates combine with water to yield hydrous monocalcium silicate, with consequent liberation of lime as calcium hydroxide.

The liberated lime is probably the constituent of concrete least resistant to the deteriorating influence of weather and water action, and the constituent that is most readily attacked by sulphates and other destructive agencies to which concrete must frequently be exposed.

Since tricalcium silicate must necessarily liberate twice as much lime in hydrating to monocalcium silicate as would be liberated by dicalcium silicate, the question naturally arises as to whether a cement relatively high in tricalcium silicate, such as Brand A, would prove as suitable for use in exposed concrete as would a cement such as Brand B.

It will be seen, therefore, that if the analysis of a cement is considered in terms of its probable constitution, we are more likely to open up avenues for a further intelligent study of its properties than if we consider the same analysis in terms of simple oxides that obviously do not exist as such at all.

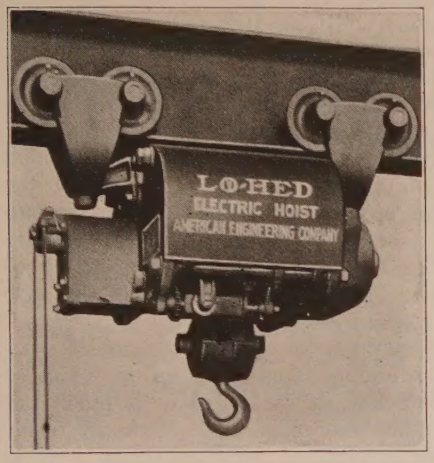
By use of the accompanying tables of the factors involved, calculation of the potential constitution of any cement can be rapidly and easily accomplished.

Mill Equipment

New Hoist for Minimum Headroom Announced

The American Engineering Company, Philadelphia, Pennsylvania, has made an addition to its line of Lo-Hed hoists, with a motor trolley electric monorail hoist that operates in 15½ inches headroom.

Switches and curves of short radius are easily traveled by the hoist. Protection



against dust and moisture is provided by metal covers. Motors are fully enclosed. Mechanical efficiency exceeds 80 per cent. A ball bearing motor designed especially for hoist service is used.

The drive between the motor and drum is of the spur gear type and runs in oil. Alemite lubrication is provided on all bearings not automatically lubricated by the oil bath.

Jeffery Conveyor Efficient

Unloading bulk materials from hopper cars without the use of a pit or trestle is the problem successfully met by a new Jeffrey portable unit, the X-Track-Tor.

The X-Track-Tor is lightly, compactly designed. A specially protected belt is used instead of the usual belt.

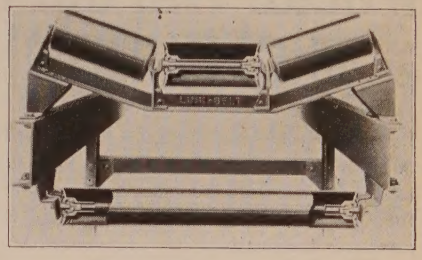
In operation the flow of the material from the car is regulated by the hopper opening and by removable cover plates over the belt. No other regulation is necessary as the X-Track-Tor will work when completely buried in material and its capacity is governed only by the capacity of a secondary unit to which it delivers. As the material flows out of the car, the removable cover plates are removed permitting the X-Track-Tor to completely empty all the material from the farthest side of the car hopper.

Caldwell Speed Reducer Combines Two Drives

The H. W. Caldwell & Son Company has entered on the speed reducer market a self-contained unit combining two separate drives—a Link-Belt Silent Chain Drive from the high speed shaft, and a cut spur gear drive to the low speed shaft. A flexible coupling on the motor shaft is not necessary, since the chain drive provides flexibility between the motor and the speed reducer shaft. All through-shafts have been made over-size, with substantial bearing supports. Timken roller bearings are used.

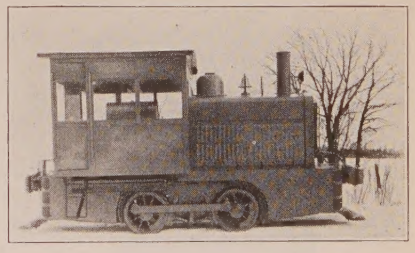
Link-Belt Develops New Conveyor Idler

A belt conveyor idler and return rolls of a highly developed type is announced by the Link-Belt Company, Chicago. Timken tapered roller bearings, totally encased within the roll hub, are employed.



One of the features of the idler is the positive protection secured by a labyrinth grease seal, mounted in a grease cup. This serves also as an outboard reservoir and lubricates the bearing on the outside as well as on the inside, particularly when the roll is on an incline. This, in turn, is protected by a deflector plate which deflects dirt, dust, grit or any foreign material away from the bearings and grease seal.

A Giant 30-Ton "Whitcomb"



George D. Whitcomb Company, Rochelle, Illinois, has recently built and sold one of the largest gasoline haulage tools ever built, with the possible exception of a type for experiment purposes.

This Giant "Whitcomb" is powered with a 6 cylinder 6½x7 Beaver engine, capable of developing 160 horsepower at 1000 revolutions per minute. It has a drawbar pull of 17,500 pounds on low gear without sand.

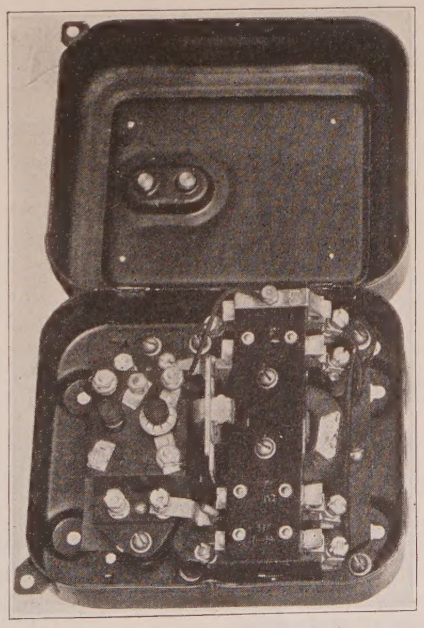
The frame is of solid type construction, axles of forged steel and wheels with chilled tread, or of any type required by the purchaser. Transmission allows for all speeds, either forward or reverse, and sand is furnished at all four wheels.

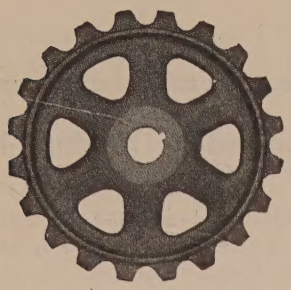
Cutler-Hammer Has New Across-the-Line Starter

The Cutler-Hammer Manufacturing Company, Chicago, Illinois, has announced as one of its new products the smallest across-the-line starter for five hp. A. C. motors, or under. It provides push-button control of starting and stopping and thermal overload protection and no-voltage protection.

The starter is provided with push-buttons in the front cover of the case. The small size in most cases permits mounting of the starter where the control station would ordinarily be placed, saving extra wiring and cost of a push-button station.

The type of contactor developed for use in this starter is a novel feature. A roller is forced between two fingers to complete the circuit. To adapt the starter for any horsepower within rating it is only necessary to insert the proper size heater coils in the thermal overload relay.





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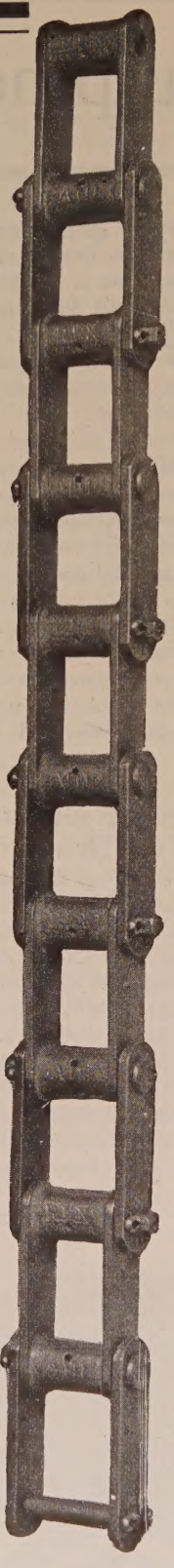

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Power Transmission Engineers

Cost of Electric Motor Burnouts

By W. F. SCHAPHORST, M.E.

I have received several inquiries concerning my remarks on the above subject which recently appeared in CONCRETE. One of the inquirers wrote: "I would like to know what sort of protection against overloads was provided for the motors in this particular installation. It seems that the protection is an important factor in the determination of the frequency of motor burnouts, and that in order to save the cost of rewinding adequate protection should be provided. According to your figures, the average rewinding cost is $83.80, which is much less than the cost of first-class motor protection apparatus. I desire this information in order to make more complete the data from your article, and I would thank you for an answer at your convenience."

No effort is made in the large plant to which I referred to get overload protection. They protect only against a stalling current or short circuit. In some special cases they do differently but this is the general rule.

One of the many abstract problems facing the officials of most manufacturing plants is the cost of any breakdown, whether mechanical or electrical.

Usually an electrical breakdown cost can be ascertained by determining the number of hours or days that the electric motor or generator is out of service. In rewinding small motors of from ¼ to 10 hp., one can usually figure a day and a half to two days, while from 15 to 40 hp., would take two or three days and above this size would take three days to a week.

Any plant using a quantity of electric motors of various sizes should keep enough spare motors on hand to use as substitutes when one of the regulars is burnt out or for some reason taken out of service. Although their problems may not be exactly the same as yours, here is an example: Two large automobile manufacturing concerns have standardized on certain motors of so-called "300 frame series." When a 10-hp. motor is burned out or the bearings become worn and need repairs, it is taken off the rails and another motor of the same frame size put in its place. The machinery is probably tied up twenty minutes to half an hour by doing this. Both companies have at least one spare motor of every frame size which they use throughout their plant.

Bureau Determines New Lime-Soundness Test

In an effort to arrive at a method for determining the soundness of hydrated lime in less than the present minimum of three days. the Bureau of Standards recently investigated a method consisting essentially of the duplication of the process on small, thin specimens used in the manufacture of sand-lime brick.

The pressure used in making the test pieces was 10,000 pounds per square inch for the major portion of the work and 6,000 pounds per square inch for the remainder. Handling without breakage was more difficult of specimens made with the lower pressure. The specimens were then steamed in an autoclave at 140 pounds per square inch pressure for five hours.

Specimens which contained unsound lime in the slightest degree completely disintegrated or cracked badly during the steaming process. In every instance in which lime was unsound by the usual test the sand-lime brick test corroborated the results. The conclusion was consequently reached that the sand-lime brick method is fully as accurate as the present standard method, while the time required for the completion of a test of lime for soundness is only one-third.